

Final Report

Biological Surveys – Report 1

Various Locations on Guam in Support of the Guam and Commonwealth of the Northern Mariana Islands Military Relocation (2012 Roadmap Adjustments) Supplemental Environmental Impact Statement

Prepared for:

Joint Guam Program Office
Washington, DC

Prepared by:

Naval Facilities Engineering Command Pacific

Under Contract Number N62742-11-D-1801

Task Order No. 0008

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EXECUTIVE SUMMARY

In February 2012, the United States (U.S.) Department of the Navy (DON) initiated a Supplemental Environmental Impact Statement (SEIS) to evaluate the environmental consequences of establishing a live-fire training range complex (LFTRC) on Guam in support of the relocation of U.S. Marine Corps forces from Okinawa to Guam (the "LFTRC SEIS").

On April 27, 2012 (Eastern Daylight Time), the U.S.-Japan Security Consultative Committee (SCC) issued a joint statement announcing its decision to adjust the plans outlined in the May 2006 Realignment Roadmap. In accordance with the SCC's adjustments (the "2012 Roadmap Adjustments"), the Department of Defense adopted a new force posture in the Pacific, providing for a substantially smaller U.S. Marine Corps relocation to Guam.

As a result of the 2012 Roadmap Adjustments, the DON expanded the scope of the LFTRC SEIS to also evaluate the potential environmental consequences from construction and operation of a main cantonment area, including family housing, and associated infrastructure to support the relocation of a substantially reduced number of Marines than previously analyzed. The SEIS will supplement the 2010 Final Environmental Impact Statement (EIS) for the Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation.

This report identifies biological resources within the potential direct impact areas associated with the Guam and CNMI Military Relocation (2012 Roadmap Adjustments) SEIS. Potential direct impact areas are those proposed for range construction associated with the LFTRC. Based on a data gap analysis undertaken by Naval Facilities Engineering Command Pacific, this report includes the results of planning level in-fill surveys within areas lacking sufficient data to evaluate potential impacts. The survey areas include, but are not limited to, previously unsurveyed portions of the potential direct impact areas as shown in notional designs available in November 2012. Surveys were conducted by a TEC-AECOM Pacific Joint Venture (JV) team.

Results contained within this report focus primarily on two new areas being considered for range placement: the northwest portion of the Naval Munitions Site (NMS) and a Private Lands Site (PLS) to the southeast of the NMS. The following ranges are proposed:

- Hand grenade (HG)
- Known distance pistol (KDP)
- Known distance rifle (KDR)
- Multipurpose machine gun (MPMG)
- Modified record of fire (MRF)
- Non-standard small arms (NSSA)

Three alternative range configurations are being considered: North/South (N/S), L-shaped (L), and East/West (E/W).

The biological surveys summarized in this report documented vegetation communities and the presence, potential presence, or absence of special-status species at representative locations on or in the vicinity of the proposed ranges. For the purposes of this report, special-status species include those listed as endangered, threatened, or candidate species under the federal Endangered Species Act (ESA); listed as endangered or threatened under the Guam ESA; migratory bird species protected under the Migratory Bird Treaty Act (MBTA); and Guam-listed Species of Greatest Conservation Need (SOGCN). The scope of the biological surveys included only those special-status species that have the potential to currently

occur in the wild on Guam (i.e., are not extinct, extirpated, or only occur in captivity). The bird and bat species were surveyed at stations either within the proposed range footprints, within 100-meter (m) buffers surrounding the ranges, or further away from range footprints in potential surface danger zones. Other species and vegetation were surveyed only within range footprints and buffers. Results reported here are based on observations and measurements during surveys of representative locations. Results from these locations are assumed to be representative of other areas not surveyed. Table ES-1 summarizes the biological survey findings for special-status species.

Table ES-1. Summary of 2012 Surveys for Special-Status Species within Proposed LFTRC Configurations on NMS and PLS

Scientific Name	Common Name	Federal ESA Status	Guam Status	NMS Obs	PLS Obs
Plants					
<i>Cyathea lumulata</i>	Tree fern (<i>Chacha</i> or <i>Tsatsa</i>)	None	Endangered, SOGCN	no	no
<i>Cycas micronesica</i>	Federico nut (<i>Fadang</i>)	None	SOGCN	Yes (MPMG)	Yes (KDP-L)
<i>Elatostema calcareum</i>	None (None)	*	None	no	no
<i>Heritiera longipetiolata</i>	None (<i>Ufa-halomtano</i>)	None	Endangered SOGCN	no	no
<i>Merrilliodendron megacarpum</i>	None (<i>Faniok</i>)	None	SOGCN	Yes (MPMG)	no
<i>Procris pedunculata</i>	None (None)	*	None	Yes (MPMG)	no
<i>Serianthes nelsonii</i>	Fire tree (<i>Hayun lagu</i>)	Endangered	Endangered, SOGCN	no	no
<i>Tabernaemontana rotensis</i>	None (None)	None	SOGCN	Yes (MPMG)	no
Mammals					
<i>Pteropus m. mariannus</i>	Mariana fruit bat (<i>Fanihi</i>)	Endangered	Endangered, SOGCN	Yes	no
Birds**					
<i>Aerodramus bartschi</i>	Mariana swiftlet (<i>Chachaguak</i>)	Endangered	Endangered, SOGCN	no	Yes
<i>Aplonis opaca guami</i>	Micronesian starling (<i>Sali</i>)	None	Endangered, SOGCN	no	no
<i>Gallinula chloropus guami</i>	Mariana common moorhen (<i>Pulattat</i>)	Endangered	Endangered, SOGCN	Yes (MPMG, MRF)	no
Reptiles					
<i>Lipinia noctua</i>	Moth skink (<i>Guali'ek</i> <i>Halom Tano'</i>)	None	Endangered, SOGCN	no	no
<i>Nactus pelagicus</i>	Pacific slender-toed gecko (<i>Guali'ek</i>)	None	Endangered	Yes (MPMG)	no
Invertebrates					
<i>Partula gibba</i>	Humped tree snail (<i>Akaleha'</i>)	Candidate	Endangered SOGCN	no	no
<i>Partula radiolata</i>	Guam tree snail (<i>Akaleha'</i>)	Candidate	Threatened SOGCN	no	no
<i>Samoana fragilis</i>	Fragile tree Snail (<i>Akaleha'</i>)	Candidate	Endangered SOGCN	no	no

Notes: *This species is a host plant for the federal ESA candidate Mariana eight-spot butterfly (*Hypolimnys octocula mariannensis*); **Species listed only under the MBTA are not included in this summary; Obs = Observation.

NMS Survey Results

Vegetation. The vegetation on large portions of the proposed MPMG range footprint and 100-m buffer was determined to be primary limestone forest. This forest type has never been cleared and was relatively undisturbed. It contained a diversity of plant species, but the dominant species in many areas were *Pandanus dubious*, *P. tectorius*, *Neisosperma oppositifolia*, and *Guamia mariannae*. The first three species are trees of small to moderate size and the last species is a common understory tree.

Large areas of forested wetland vegetation were present within the proposed KDR range footprint and 100-m buffer, in particular associated with the Talisay River aligned through a portion of the proposed range footprint and buffer. The northern and eastern portions of the proposed range footprint and 100-m buffer contained forested wetland dominated by native species. The southern and western portions contained more degraded, sparse herbaceous-scrub vegetation. Other proposed ranges and associated buffers had vegetation dominated by non-native, introduced plant species.

Plants. The special-status plant species identified in surveys at NMS within the proposed MPMG range footprint and 100-m buffer were the trees *Merrilliodendron megacarpum* and *Tabernaemontana rotensis*, and the endemic cycad *Cycas micronesica*. Several patches of *Merrilliodendron megacarpum* were noted in the southwestern buffer of the proposed MPMG range along a general north-south trending line. These patches were small, with the largest approximately 100 feet (ft) (30 m) in diameter, and consisting of several dozen trees. A single specimen of the tree species *Tabernaemontana rotensis* was found within the western buffer of the proposed MPMG range. The cycad was found at a few locations within the proposed MPMG range footprint and buffer and also in a somewhat concentrated linear pattern in one area through the range footprint and into the 100-m buffer; an estimated 30-40 individuals were present in this concentrated area. This cycad is designated a SOGCN species because of its rapid decline, due primarily to an island-wide scale insect (*Aulacaspis yasumatsui*) infestation.

Procris pedunculata, a host plant for the ESA candidate species Mariana eight-spot butterfly, was observed in patches that were usually small (less than 25 ft [7.6 m] in diameter) at multiple distinct locations within the proposed MPMG range footprint and 100-m buffer. One substantially larger 4,000-square ft (370 square m) patch was observed within the proposed MPMG range footprint.

Mammals. Seven separate detections of a single Mariana fruit bat were recorded during overlook surveys conducted on six separate occasions at four locations throughout the proposed range areas. It could not be determined whether these observations represented a single individual or multiple individuals. It is possible that all sightings were of the same individual fruit bat observed on different occasions or at different locations.

Birds. A single Mariana common moorhen was observed at each of two separate pond locations within the survey area. It could not be determined whether these observations represented the same or different individuals. No bird species listed under the MBTA were detected during station surveys or overlook surveys. However, two native species listed under the MBTA were observed while transiting to and from overlook stations on NMS: yellow bittern (*Ixobrychus sinensis*) and white tern (*Gygis alba*).

Reptiles. Five individual Pacific slender-toed geckoes were detected, two within the proposed MPMG range footprint and three within the proposed MPMG range 100-m buffer. No other special-status reptile species were detected.

Invertebrates. No live tree snails were observed during the surveys. Potential tree snail habitat and dead, bleached tree snail shells were noted at the proposed MPMG range footprint and 100-m buffer.

PLS Survey Results

Vegetation. The dominant vegetation on all proposed ranges was savanna, usually with a mix of native and non-native grass species. Several proposed range footprints and associated 100-m buffers also contained substantial areas of barren land (badland) with no vegetation or only very sparse cover. The proposed MPMG-E/W range footprint and 100-m buffer and the proposed KDR-L range footprint (the latter range footprint is entirely within the proposed MPMG range footprint) also contained large areas of herbaceous wetland vegetation, dominated primarily by native plant species. There were a few small areas of ravine forest at the edge of the 100-m buffer for some of the proposed ranges.

Plants. A few individuals of the endemic cycad were observed in the small ravine forest at the outer edge of the 100-m buffer of the proposed KDP-L range.

Birds. Mariana swiftlets were observed during all six surveys from two of the four overlook stations with as many as 11 birds sighted from one location. Swiftlets were also observed at the other two stations but not during all six survey events. Two native species listed under the MBTA, yellow bittern and white tern, were observed while transiting to and from overlook stations and while at overlook stations on PLS.

No other special-status species were detected during surveys on PLS.

Species Summary

Wildlife species observed on NMS included one species listed under the federal ESA and two species listed under the Guam ESA. Wildlife species observed on PLS include one species listed under the federal and Guam ESAs and two bird species protected under the MBTA. Three plant SOGCN were observed on NMS and one on PLS. Although not a special-status species, a species that is a host plant for the ESA candidate Mariana eight-spot butterfly was identified on NMS. No federal ESA candidate species were observed. Results are summarized in Table ES-1.

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base	LFTRC	live-fire training range complex
CNMI	Commonwealth of the Northern Mariana Islands	m	meter(s)
CWCS	Comprehensive Wildlife Conservation Strategy	MBTA	Migratory Bird Treaty Act
DoD	Department of Defense	MPMG	multipurpose machine gun
DON	Department of the Navy	MRF	modified record of fire
E/W	East/West	NAVFAC	Naval Facilities Engineering Command
EIS	Environmental Impact Statement	NMS	Naval Munitions Site
ESA	Endangered Species Act	N/S	North/South
ft	foot/feet	NSSA	non-standard small arms
GDAWR	Guam Division of Aquatic and Wildlife Resources	Obs	Observation
GovGuam	Government of Guam	PLS	Private Lands Site
GPEPP	Guam Plant Extinction Prevention Program	SDZ	surface danger zone
ha	hectare(s)	SEIS	Supplemental Environmental Impact Statement
HG	hand grenade	SOGCN	Species of Greatest Conservation Need
JV	TEC-AECOM Pacific Joint Venture	SWCA	SWCA Environmental Consultants
KDP	known distance pistol	UoG	University of Guam
KDR	known distance rifle	U.S.	United States
L	L-Shaped	USC	U.S. Code
		USFWS	U.S. Fish and Wildlife Service
		USGS	U.S. Geological Survey

1.0 INTRODUCTION AND RESOURCE BACKGROUND

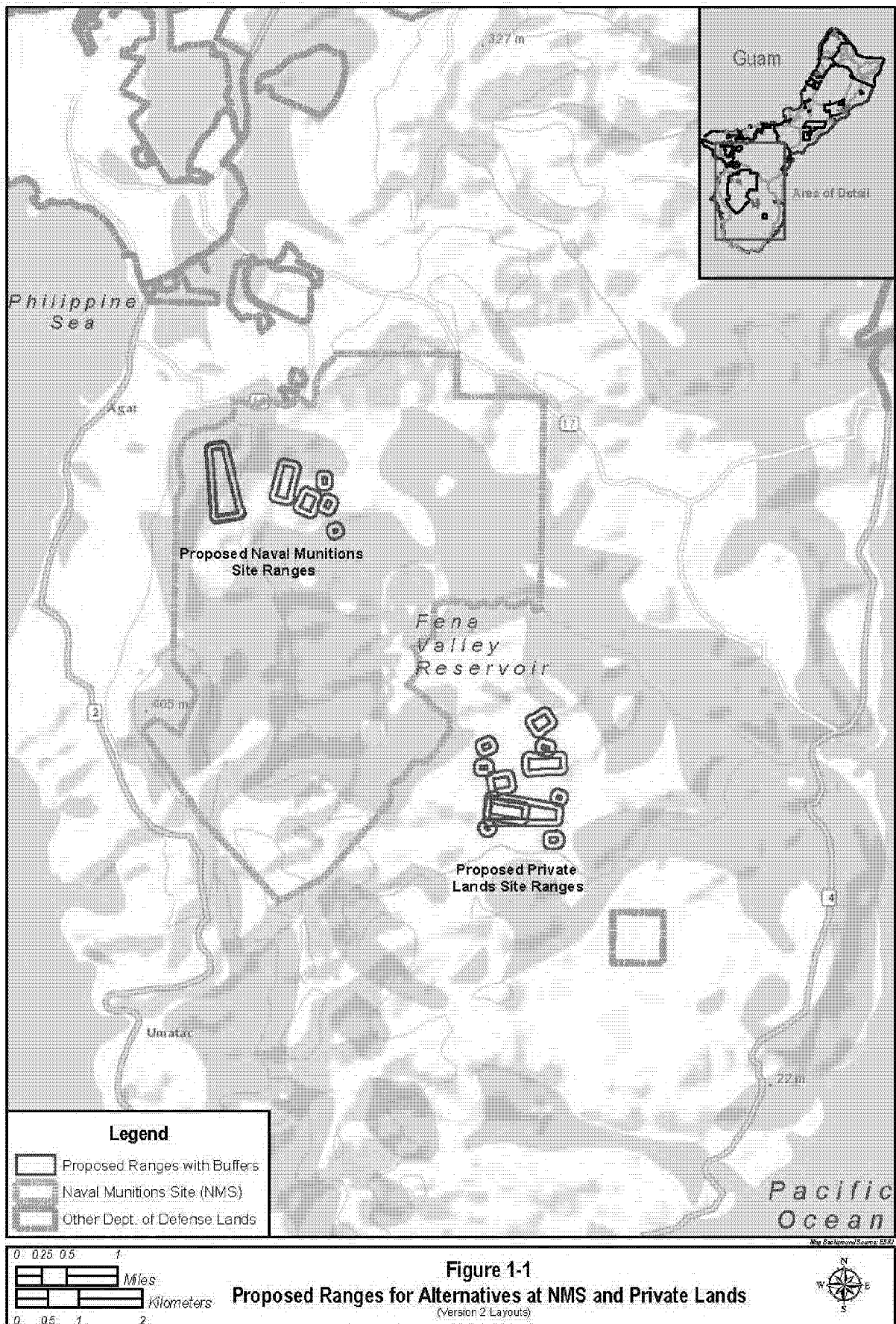
1.1 INTRODUCTION

This document identifies biological resources within the potential direct impact areas associated with the Guam and Commonwealth of the Northern Marianas (CNMI) Military Relocation (2012 Roadmap Adjustments) Supplemental Environmental Impact Statement (SEIS). Potential direct impact areas are those proposed for range construction associated with a live-fire training range complex (LFTRC). Based on a data gap analysis undertaken by Naval Facilities Engineering Command (NAVFAC) Pacific, this report includes the results of planning level in-fill surveys within areas lacking sufficient data to evaluate potential impacts. The survey areas include, but are not limited to, previously unsurveyed portions of the potential direct impact areas as shown in notional designs available in November 2012. Surveys were conducted by a TEC-AECOM Pacific Joint Venture (JV) team.

The need for new facilities on Guam was described in the 2010 Final Environmental Impact Statement (EIS) for the Guam and CNMI Military Relocation (Department of the Navy [DON] 2010). This biological survey report describes the results for two areas being considered for relocating the ranges: the northwest portion of the Naval Munitions Site (NMS) and a Private Lands Site (PLS) to the southeast of the NMS (Figure 1-1). Three alternative range configurations are being considered. The alternative range configurations are north/south (N/S), L-shaped (L), and east/west (E/W). The N/S configuration is located entirely on NMS, the E/W configuration is located entirely on the PLS, and the L configuration is split between the two locations. The configurations include the following ranges:

- Hand grenade (HG)
- Known distance pistol (KDP)
- Known distance rifle (KDR)
- Multipurpose machine gun (MPMG)
- Modified record of fire (MRF)
- Non-standard small arms (NSSA)

The JV team was tasked to support the LFTRC planning and alternatives analysis by conducting biological surveys. Between May and November 2012, the JV conducted field surveys to locate, identify, and assess the occurrence of special-status species and vegetation within the proposed range areas within the NMS and PLS. Surveys were conducted at stations either within the proposed range footprints, within 100-meter (m) buffer areas surrounding the ranges, or further away from the range footprint within the potential surface danger zones (SDZs). Survey sites and survey protocols were established by NAVFAC Pacific with assistance from NAVFAC Marianas biologists in coordination with the JV.



The purpose of the surveys was to document vegetation communities and the presence, potential presence, or absence of special-status species in the vicinity of the proposed ranges, as well as their distribution. Special-status species include those listed as an endangered, threatened, or candidate species under the federal Endangered Species Act (ESA) (United States [U.S.] Fish and Wildlife Service [USFWS] 2011); listed as an endangered or threatened species under the Guam ESA (Government of Guam [GovGuam] 2009); species protected under the Migratory Bird Treaty Act (MBTA) (USFWS 2010); and Guam-listed Species of Greatest Conservation Need (SOGCN) (Guam Division of Aquatic and Wildlife Resources [GDAWR] 2006). For the current biological surveys and this report, special-status species include the following groups: mammals, birds, reptiles, tree snails, and plants. Surveys also included host plant species for the Mariana eight-spot butterfly (*Hypolimnys octocula mariannensis*), a candidate species for listing under the federal ESA, as well as rare plants that are not currently listed under the federal or Guam ESA or as SOGCN.

This report provides the results of the biological surveys. The main body of this report summarizes the detailed specialist survey reports that are included as appendices.

1.2 REGULATORY CONSIDERATIONS

1.2.1 Migratory Bird Treaty Act (16 U.S. Code [USC] §§703–712)

The MBTA of 1918 is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. It implements the United States’ commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The prohibition applies to birds included in the respective international conventions between the United States and Great Britain, the United States and Mexico, the United States and Japan, and the United States and the Soviet Union (now Russia).

A species qualifies for protection under the MBTA by meeting one or more of the following criteria:

1. the species belongs to a family or group of species named in the Canadian Convention of 1916, as amended in 1996; and Mexican Convention of 1936, as amended in 1972;
2. the species is listed in the annex to the Japanese Convention of 1972;
3. the species is listed in the appendix to the Russian Convention of 1976;
4. evidence exists of this species occurring naturally in the United States or its territories; and
5. documentation of such records has been recognized by the American Ornithologists’ Union or other competent scientific authorities.

Species whose occurrences in the United States are strictly the result of intentional human introduction are not protected under the MBTA. The species of birds protected by the MBTA appear in Title 50, Section 10.13 of the Code of Federal Regulations. The current list of species protected under the MBTA was released in March 2010 (USFWS 2010).

1.2.2 Federal ESA (16 USC §§1531–1544)

Enacted in 1973, the purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to provide a program for the conservation of such species. The ESA defines an *endangered species* as one “in danger of extinction throughout all or a significant portion of its range” (§1532). A *threatened species* is one that is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (§1532).

Critical habitat is defined in section 3 of the ESA as specific areas that are within or outside the geographical area occupied by a species at the time it is listed that contain physical or biological features essential to the conservation of the species, and that may require special management considerations or protection. The only area of critical habitat for ESA-listed species on Guam is located within the USFWS' Guam National Wildlife Refuge, approximately 25 miles (40 kilometers) north of the survey areas addressed in this report.

Section 4 of the ESA covers candidate and proposed species; no species proposed for listing under the federal ESA occur on Guam. A *candidate species* is a plant or animal species for which the USFWS has sufficient information on file regarding biological vulnerability and threats to support a proposal to list it as endangered or threatened under the ESA, but has not yet developed a proposed listing regulation. A candidate species receives no statutory protection under the ESA; however, the USFWS encourages conservation efforts for these species that may warrant future protection under the ESA. The most recent USFWS Candidate Notice of Review lists four candidate species that currently occur on Guam: Mariana eight-spot butterfly, fragile tree snail, Guam tree snail, and humped tree snail (USFWS 2012b).

1.2.3 Guam ESA (Guam Public Law 15-36; 5 Guam Code Annotated §63205(c)) and Comprehensive Wildlife Conservation Strategy (CWCS)

The Guam ESA was passed on June 18, 1979, and provides protection to both Guam-listed and ESA-listed threatened and endangered species on Guam. The purpose of the Guam ESA is to protect ecosystems that provide habitat to threatened and endangered species and provide a conservation program for such species.

Guam has also prepared a CWCS that identifies SOGCN in Guam (GDAWR 2006). The primary goal of the Guam CWCS is to provide for the effective management, preservation, protection, and restoration of the island's natural resources especially SOGCN, now and for the future. The GDAWR is the lead agency in the management of Guam's natural resources. This includes all management activities associated with aquatic and terrestrial fauna.

1.3 SPECIES INFORMATION

1.3.1 Special-Status Plant Species

Table 1-1 provides the list of special-status plant species found on Guam. Threatened and endangered species were identified based on available federal and Guam regulatory data. The SOGCN are an integral part of Guam's CWCS.

Table 1-1. Guam Special-Status Plant Species

Scientific Name	Common Name (Chamorro Name)	Federal ESA Status ⁽¹⁾	Guam Status ⁽²⁾
<i>Cyathea lunulata</i>	Tree fern (<i>Chacha or Satsa</i>)	None	Endangered, SOGCN
<i>Cycas micronesica</i>	Federico nut (<i>Fadang</i>)	None	SOGCN
<i>Heritiera longipetiolata</i>	None (<i>Ufa-halomtano</i>)	None	Endangered, SOGCN
<i>Merrilliodendron megacarpum</i>	None (<i>Faniok</i>)	None	SOGCN
<i>Serianthes nelsonii</i>	Fire tree (<i>Hayun-lagu</i>)	Endangered	Endangered, SOGCN
<i>Tabernaemontana rotensis</i>	None (<i>None</i>)	None	SOGCN

Sources: ⁽¹⁾USFWS 2011, 2012b; ⁽²⁾GDAWR 2006.

Cyathea lunulata

Although very little has been reported concerning the presence of *Cyathea lunulata* on Guam, this tree fern's historical habitat is on hills, in wet ravines, and on muddy drainage slopes in southern Guam (Stone 1970). Its current habitat is defined as savanna and narrow ravines (Guam Plant Extinction Protection Program [GPEPP] 2012). This species is being targeted by the GPEPP, which is an island-wide program dedicated to preventing the extinction of Guam's rarest plant species that have fewer than 50 individuals remaining in the wild (GPEPP 2012). It is listed as endangered under the Guam ESA and as a SOGCN because of its rarity and potential threats including typhoons and wildland fires (GDAWR 2006).

Cycas micronesica

Cycas micronesica, a large cycad species, was historically common throughout Guam in undisturbed limestone and ravine forests and savanna summits (Stone 1970). It is identified as a SOGCN because of the cycad scale insect and other threats including ungulate damage, typhoons, wildland fires, and development (GDAWR 2006).

Heritiera longipetiolata

Heritiera longipetiolata is a moderate-sized tree endemic to Guam, Rota, and Saipan that historically was restricted to limestone cliffs and plateaus (Stone 1970; GDAWR 2006). It is listed as endangered under the Guam ESA and identified as a SOGCN species because of its rarity, rare occurrence of flowering and fruiting, and threats from feral ungulates and typhoons (GDAWR 2006). This species is being targeted by GPEPP (GPEPP 2012).

Serianthes nelsonii

Listed as endangered under the federal and Guam ESAs and as an SOGCN, *Serianthes nelsonii* is endemic to limestone forests of Guam and Rota and is one of the largest native trees in the Marianas (USFWS 1994). Only one adult tree is known to remain on Guam, and over 60 adult trees remain on Rota (GDAWR 2006). Major threats to the species include ungulate damage, insect pests, and typhoons (USFWS 1994; GDAWR 2006). This species is being targeted by GPEPP (GPEPP 2012).

Merrilliodendron megacarpum

Merrilliodendron megacarpum is a moderate-sized tree found only in a few locations on Guam, but where it does occur it may be the dominant species in a grove. It seems to grow only where near-surface groundwater is readily available (Raulerson and Rinehart 1991; GDAWR 2006). It is considered a SOGCN because of its rarity and potential threats from ungulate damage, typhoons, development, and insect infestation (GDAWR 2006).

Tabernaemontana rotensis

A moderate-sized tree, *Tabernaemontana rotensis* grows on limestone and was once thought to be rare on Guam. Herbivory and insect infestations were thought to be the major factors limiting its abundance and resulted in its designation as a SOGCN (GDAWR 2006). The USFWS previously thought the Guam and Rota *Tabernaemontana* populations to be a local form of *T. pandacaqui* (USFWS 2004) but it has now been shown to be a separate species (Harbaugh 2012). Surveys conducted in 2005 and 2006 indicate this species is not as rare on Guam as once thought. More than 21,000 individuals were found throughout Andersen Air Force Base (AFB) during a systematic survey (University of Guam [UoG] 2007).

1.3.2 Special-Status Mammal and Bird Species

Table 1-2 provides the list of mammal and bird species listed under the federal or Guam ESA or designated a SOGCN. A major factor in the distribution of avian species on Guam is the presence of the brown tree snake (*Boiga irregularis*). The brown tree snake is nocturnal, hunts and lives in trees, and is known to prey on birds and their eggs. The introduction of the brown tree snake on Guam has led to the extirpation of several native bird species from Guam (USFWS 1990b). These species are noted in Table 1-2.

Those species evaluated during field surveys reported here are listed and noted in bold in Table 1-2 and discussed further below. Species listed under the MBTA were also evaluated during field surveys.

Table 1-2. Guam Special-Status Mammal and Bird Species

Scientific Name	Common Name (Chamorro Name)	Federal ESA Status ⁽¹⁾	Guam Status ⁽²⁾	Population Status ^{*,(3)}
<i>Pteropus m. mariannus</i>	Mariana fruit bat (<i>Fanihi</i>)	Endangered	Endangered, SOGCN	p
<i>Zosterops c. conspicillatus</i>	Guam bridled white-eye (<i>Nossa</i>)	Endangered	Endangered	ext
<i>Rallus owstoni</i>	Guam rail (<i>Koko</i>)	Endangered	Endangered, SOGCN	cap
<i>Gallinula chloropus guami</i>	Mariana common moorhen (<i>Pulattat</i>)	Endangered	Endangered, SOGCN	p
<i>Corvus kubaryi</i>	Mariana crow (<i>Aga</i>)	Endangered	Endangered, SOGCN	x
<i>Aerodramus bartschi</i>	Mariana swiftlet (<i>Yayaguak</i>)	Endangered	Endangered, SOGCN	p
<i>Todiramphus c. cinnamomina</i>	Guam Micronesian kingfisher (<i>Sihek</i>)	Endangered	Endangered, SOGCN	cap
<i>Megapodius laperouse</i>	Micronesian megapode (<i>Sasangat</i>)	Endangered	Not listed	x
<i>Acrocephalus luscinius</i>	Nightingale reed-warbler (<i>Ga'ga' Karisu</i>)	Endangered	Not listed, SOGCN	x
<i>Ptilinopus roseicapilla</i>	Mariana fruit dove (<i>Totot</i>)	None	Endangered, SOGCN	x
<i>Myzomela rubratra saffordi</i>	Micronesian honeyeater (<i>Egigi</i>)	None	Endangered, SOGCN	x
<i>Aplonis opaca guami</i>	Micronesian starling (<i>Sali</i>)	None	Endangered	p
<i>Rhipidura rufifrons uraniae</i>	Rufous fantail (<i>Na'abak</i>)	None	Endangered	x
<i>Gallicolumba xanthonura</i>	White-throated ground dove (<i>Puluman apaka</i> [male] and <i>fache</i> [female])	None	Endangered, SOGCN	x

Notes: *cap = extirpated in the wild, captive population on Guam; ext = extinct; p = present; x = extirpated from Guam but present within the CNMI. **Bold** = species addressed in this report. MBTA species are not listed.

Sources: ⁽¹⁾USFWS 2011, 2012g; ⁽²⁾GDAWR 2006; ⁽³⁾DON 2010.

Mariana Fruit Bat

The Mariana fruit bat is a medium-sized colonial fruit bat. It was federally listed as endangered on Guam by the USFWS in 1984 (USFWS 1984) and is also listed as endangered under the Guam ESA (GovGuam

2009). However, in 2005, the USFWS determined that movement of fruit bats between all islands in the Mariana archipelago occurs, resulting in exchange of genetic material. Consequently, Mariana fruit bats on Guam and throughout the CNMI comprise one subspecies and are now federally listed as threatened throughout their entire range (USFWS 2005). In the Mariana Islands, the Mariana fruit bat is known to occur on all islands extending northward from Guam to Maug (Wiles et al. 1989; Johnson 2001; USFWS 2009).

While solitary roosting individuals are somewhat common, Mariana fruit bats are considered colonial and the colonies range in size from a few to as many as 2,000 individuals (Wiles 1987; Wiles et al. 1989; Worthington and Taisacan 1995). Large colonies of more than 1,000 individuals are rare. Islands with low fruit bat numbers usually support smaller roosts with fewer than 75 individuals (Wiles and Johnson 2004).

The Mariana fruit bat is typically associated with a number of forest types, including primary and secondary limestone forest, *Cocos nucifera* forest, *Casuarina equisetifolia* groves, and ravine forest (Wiles et al. 1989; Johnson 2001; Worthington et al. 2001; Wiles and Johnson 2004). A variety of tree species are known to be used for roosting. A total of 39 plant species have been documented as fruit bat food sources in the Mariana Islands: fruits (29 species), flowers (15 species), and leaves (2 species). These include *Artocarpus altilis*, *Artocarpus mariannensis*, *Barringtonia asiatica*, *Cocos nucifera*, *Cycas micronesica*, *Elaeocarpus joga*, *Erythrina variegata*, *Ficus prolixa*, *Ficus tinctoria*, *Freycinetia reineckeii*, *Mammea odorata*, *Neisosperma oppositifolia*, *Ochrosia mariannensis*, *Pandanus tectorius*, and *Terminalia catappa* (Wiles and Fujita 1992; Wiles and Johnson 2004).

In 1931, Coultas (1931, as cited in USFWS 1990a) reported that fruit bats on Guam were most abundant in the northern region of the island. In 1945, Baker (1948, as cited in USFWS 1990a) determined that fruit bats were scarce in southern Guam, and uncommon and primarily restricted to the forested cliff lines in northern Guam. Woodside (1958, as cited in USFWS 2009) estimated less than 3,000 fruit bats inhabited Guam. Throughout the 1960s and 1970s, fruit bat numbers decreased considerably, plummeting to less than 50 individuals in 1978 (Wiles et al. 1989). However, between 1980 and 1982, numbers rapidly increased to approximately 850-1,000 individuals, potentially resulting from immigration of fruit bats from Rota due to illegal hunting activities on that island (Wiles 1987; Wiles et al. 1989). Following a 1984 Guam census, 425-500 individuals were recorded, indicating a decline since the early 1980s (Wiles 1987).

From 1987 to 1995, Guam's fruit bat numbers fluctuated between 200 and 750 individuals primarily confined to the limestone forest near the cliff lines on Andersen AFB (Wiles et al. 1995). Throughout 1981 to 1994, Mariana fruit bat colonies were documented at 21 sites on Andersen AFB: 11 at Pati Point and 10 between Ritidian Point and the northern region of Tarague basin (Wiles et al. 1995). In 2006, numbers had again decreased to less than 100 fruit bats, primarily restricted to a single colony with satellite individuals inhabiting the limestone forest on Andersen AFB (Janeke 2006). Between 2007 and 2011, the number dropped to approximately 25 fruit bats (SWCA Environmental Consultants [SWCA] 2012a). Illegal hunting appears to be the key reason for the fruit bat's dramatic decline on Guam, while habitat destruction and predation by introduced brown tree snakes may also be contributing factors (Wiles et al. 1989, 1995; Morton and Wiles 2002; Brooke 2008; USFWS 2009).

Mariana Swiftlet

The Mariana swiftlet is a small (4 inch [10 centimeter]), mostly sooty-black, slender-winged bird historically found on Saipan, Tinian, Aguiguan, Rota, and Guam (Chantler and Driessens 2000). The species is currently found only on Saipan, Aguiguan, and Guam (Cruz et al. 2008). The Mariana swiftlet is thought to have colonized the Mariana Islands from the Malayan region probably by way of the Philippines and Palau (Baker 1951). Although historically abundant on Rota at least until the 1940s, the island's population declined until it disappeared in the 1970s. In the following decade, Pratt et al. (1987) suggested Rota's swiftlet population was extirpated. The Mariana swiftlet was classified as an endangered species and listed by the USFWS in 1984 (USFWS 1984) and is also listed as endangered under the Guam ESA (GovGuam 2009). Mariana swiftlets are most threatened by human activities that disturb roosting and nesting caves such as guano mining and vandalism (USFWS 1991a).

There are 19 known Mariana swiftlet colonies in the Mariana Islands: Guam (3 colonies), Aguiguan (6 colonies), and Saipan (10 colonies) (Cruz et al. 2008; Grimm 2008; NAVFAC Marianas 2011). On Guam, surveys at Mahlac Cave in November 2010, February 2011, May 2011, and October 2011 yielded estimates of 1,073, 976, 985, and 1,344 Mariana swiftlets, respectively (NAVFAC Marianas 2011). Additional colonies persist in Maemong and Fachi Caves on Guam; however, numbers have never exceeded 100 individuals at each cave (Grimm 2008; NAVFAC Marianas 2011).

The Mariana swiftlet has an unusual capability to echolocate that allows it to utilize caves for roosting and nesting. Typical swiftlet caves are greater than 6 feet (ft) (2 m) high containing chambers with dark zones where the birds nest (USFWS 1991a). Although primarily crepuscular feeders (Pratt et al. 1987), swiftlets forage over a wide variety of terrain and vegetation, favoring ridge crests and open grassy areas where they capture small insects while flying (USFWS 1991a). Engbring et al. (1986) also found Mariana swiftlets utilizing a diversity of habitats; however, small openings in the vegetation were used more often. Analysis of guano collected from Aguiguan's Guano Cave in 2008 identified six orders of insects in the diet of Mariana swiftlets on the island (Valdez et al. 2011). In addition to Coleoptera, Isoptera, Diptera, Hemiptera, and Psocoptera, Hymenopterans were the foremost prey consumed by swiftlets.

Mariana Common Moorhen

The Mariana common moorhen was listed by the USFWS as endangered in 1984 (USFWS 1984) and is also listed as endangered under the Guam ESA (GovGuam 2009). This species is found primarily in freshwater wetland habitats (both natural and man-made) and occasionally within brackish wetland areas (USFWS 2012a). Its preferred wetland habitat is comprised of both an open water feature and edge cover that offers foraging, nesting, and cover.

The limited available historical data indicate that populations on Guam were at one time numerous and widely distributed and that major wetland areas supported substantial populations; they were also found in wetland agricultural areas such as taro patches and rice fields (USFWS 1991b).

Takano and Haig (2004) surveyed moorhens on Guam in the dry season of 2001. Of the 90 birds estimated to be on Guam during the survey, 38 were found at wetlands in the NMS. Of these, 33 were observed at the Fena Reservoir and the rest were observed at the Fena dam spillway and an NMS pond. During the dry season, most moorhens reside on Fena Reservoir because other wetland habitats are hydrologically intermittent (Takano and Haig 2004). During the dry season, the water level at the reservoir drops substantially, causing floating and emergent vegetation to closely border the shoreline,

where moorhens forage. Six moorhens were observed during April 2009 surveys at Fena Reservoir during the dry season (Eggleston 2009). However, the most recent 5-year average for surveys on Fena Reservoir has been fewer than two birds per survey and the decrease seems to be a result of the decline of *Hydrilla verticillata*, a water plant used by moorhens as a nesting substrate (Brooke and Grimm 2008; Brooke 2011). USFWS (2012a) estimates the current Guam population to be 100-150 birds.

1.3.3 Special-Status Reptile Species

There are 23 known terrestrial lizards, snakes and amphibians on Guam (see Appendix D for a complete list) but only the lizard group (skinks and geckos) has members that are designated special-status species.

Native terrestrial reptiles on Guam were historically composed of skinks and geckos. Skinks are small, smooth-skinned lizards with scales. Most are diurnal (active during the day), but can be observed at night when disturbed. Although these quick-moving species are often observed on the ground, they can climb trees if necessary. Some species lay eggs (oviparous) while others give birth to live young (viviparous) (Vogt and Williams 2004). Geckos are lizards with specialized toe pads, which enable them to climb almost any surface type. They are normally nocturnal (active at night).

Of the 11 native reptile species, only 3 are known to currently occur on Guam and they are rare and currently known only from restricted localities: moth skink, tide-pool skink, and Pacific slender-toed gecko (Table 1-3). The tide-pool skink is restricted to coastal habitats and does not occur within the survey areas addressed in this report. Only the moth skink and Pacific slender-toed gecko are potentially within the survey areas and are described below.

Table 1-3. Guam Special-Status Reptile Species

Scientific Name	Common Name (Chamorro Name)	Guam Status	Habitat	Population Status ^{*,(1)}
<i>Cryptoblepharis poecilocephalus</i>	Snake-eyed skink (<i>Guali'ek Halom Tano'</i>)	Endangered, SOGCN	Coastal areas on rocks and shrubs	x
<i>Emoia cyanura</i>	Azure-tailed skink (<i>Guali'ek Halom Tano'</i>)	Endangered, SOGCN	Hot, dry, open areas, particularly near the coast; only Cocos Isl.	x
<i>Emoia slevini</i>	Slevin's skink (<i>Guali'ek Halom Tano'</i>)	Endangered, SOGCN	Forest floors, tree trunks, and in old fields	x
<i>Lipinia noctua</i>	Moth skink (<i>Guali'ek Halom Tano'</i>)	Endangered, SOGCN	Large tree trunks with loose bark in forested areas	p
<i>Perochirus ateles</i>	Micronesian gecko (<i>Guali'ek</i>)	Endangered, SOGCN	Primarily native limestone forest; also in untended coconut groves	x
<i>Emoia atrocostata</i>	Tide-pool skink (<i>Guali'ek Kantun Tasi</i>)	Endangered	Coastal zone	p
<i>Gehyra oceanica</i>	Oceanic gecko (<i>Achiak</i>)	None	Trees, vegetation, and stony outcrops	x
<i>Nactus pelagicus</i>	Pacific slender-toed gecko (<i>Guali'ek</i>)	Endangered	Primarily ground dwelling, mainly observed in rocky areas in forests	p

Notes: *p = present; x = extirpated from Guam but present on other islands of CNMI. **Bold** = species addressed in this report. None of the reptile species are federally listed.

Sources: ⁽¹⁾GDAWR 2006; GovGuam 2009; SWCA 2010.

Moth Skink

Moth skinks reach approximately 2.1 inches (55 millimeters) in body length and are usually brown to tan with a characteristic yellow spot on the head. Moth skinks are often found on low limbs and tree trunks.

To escape predators, it is capable of breaking off its toes and tail (U.S. Geological Survey [USGS] 2005). The species is viviparous, which is not known in any other lizard species found in the Marianas (Vogt and Williams 2004). Moth skinks are one of the only diurnal, primarily arboreal species in the region (Rodda et al. 1991). Although moth skinks are widespread across the western Pacific, Guam is the only island in the Marianas on which the species definitely occurs. Moth skinks are not common but can still be found in native forests in central Guam on large tree trunks with loose bark. As of the early 1990s, the species was known from Hilaan Point, Haputo Beach, and Achae Point along Guam's northwest coast (GDAWR 2006). SWCA (2010) recorded five individuals of this species at NMS; and one each at Cabras, Andersen AFB, and North Finegayan.

Pacific Slender-toed Gecko

The Pacific slender-toed gecko is gray, with dark bands and small bumps on its back and tail. A distinguishing feature of the species is its straight non-adhesive toes, which are thin compared to the large toe pads of other geckos (USGS 2005). Unlike other geckos on Guam, Pacific slender-toed geckos are primarily ground dwelling, mainly observed in rocky areas (Wiles et al. 1990). At night, the gecko can be found foraging on the ground and rocky substrates. This species is comprised only of females, and utilizes an asexual form of reproduction known as parthenogenesis (USGS 2005), whereby development of embryos occurs without fertilization by a male. Captures of the Pacific slender-toed gecko have been rare since 1945. The decline of this species is possibly a result of the introduction of the brown tree snake and the musk shrew (*Suncus murinus*) (USGS 2005). Recent sightings have occurred in restricted areas in the northern limestone forests of Guam (Rodda 2003). Additionally, four specimens were found on the small southern off-shore islet Anae (near Agat) between 1994 and 1997 (Perry et al. 1998). Rota and Tinian are known to support Pacific slender-toed geckos (USGS 2005). SWCA (2010) recorded five individuals of this species at NMS and nine individuals at North Finegayan.

1.3.4 Special-Status Invertebrate Species

Surveys targeted three species of tree snails, all in the family Partulidae. Although Mariana eight-spot butterflies were not surveyed, their host plants, *Procris pedunculata* and *Elatostema calcareum*, were evaluated; therefore, the butterfly is included here. Species names and federal and Guam listing status are provided in Table 1-4.

Table 1-4. Guam Special-Status Invertebrate Species

Scientific Name	Common Name (Chamorro Name)	Federal ESA Status ⁽¹⁾	Guam Status ⁽²⁾	Population Status ^{*,(3)}
<i>Hypolimnas octocula mariannensis</i>	Mariana eight-spot butterfly (Ababang)	Candidate	None	p
<i>Partula gibba</i>	Humped tree snail (Akaleha')	Candidate	Endangered, SOGCN	p
<i>Partula radiolata</i>	Guam or Pacific tree snail (Akaleha')	Candidate	Threatened, SOGCN	p
<i>Partula salifana</i>	Mt. Alifan tree snail (Akaleha')	None	Endangered*	ext
<i>Samoana fragilis</i>	Fragile tree snail (Akaleha')	Candidate	Endangered, SOGCN	p

Notes: *ext = extinct; p = present; **Bold** = species addressed in this report. *Although believed extinct, this is the current official status (GovGuam 2009).

Sources: ⁽¹⁾USFWS 2012b; ⁽²⁾GovGuam 2009; ⁽³⁾Smith et al. 2008.

Humped Tree Snail

The humped tree snail is the most widely distributed tree snail in the Mariana archipelago and was originally known from nine islands: Guam, Rota, Aguiguan, Tinian, Saipan, Anatahan, Sarigan, Alamagan, and Pagan (Smith et al. 2008). However, recent surveys indicate that 14 populations occur on only 7 islands: Guam, Rota, Aguiguan, Sarigan, Saipan, Alamagan, and Pagan (USFWS 2012c).

Once considered the most abundant of the partulids in some areas on Guam (Crampton 1925), the only extant humped tree snail population on the island is known from the Haputo Beach region (Hopper and Smith 1992; Smith et al. 2008); however, colonies have declined greatly in number (USFWS 2012c). Habitat loss and modification, and predation by introduced rosy carnivore snails (*Euglandina rosea*), Manokwar flatworms, and rats (*Rattus* spp.) currently threaten this tree snail species (USFWS 2012b).

Guam Tree Snail

The Guam tree snail is endemic to Guam (Smith et al. 2008). By 1989, this species replaced the humped tree snail as the predominant partulid species on Guam and could be found in the northern, central, and southern regions of the island (Smith and Hopper 1994). Currently, there are 22 known populations of the Guam tree snail, with all but 8 of the populations on privately owned lands; the remaining populations are on lands owned by the Department of Defense (DoD) (USFWS 2012d).

In 1989, Hopper and Smith (1992) resurveyed 34 of 39 sites originally identified by Crampton (1925) plus 13 new sites. Hopper and Smith (1992) found 9 of the 34 sites still supported Guam tree snails. Of the 13 new sites (i.e., sites not identified by Crampton [1925]), 7 supported populations of the Guam tree snail. However, one of these was eliminated between 1991 and 1992 by wildfires that burned into ravine forest occupied by the snails (Smith and Hopper 1994). Additional surveys by Smith (1995) found five additional populations of the Guam tree snail. Surveys of 15 sites on NMS located one additional population and shells of tree snails were found in abundance on the ground at all locations (USFWS 2012d). Two colonies of the Guam tree snail were discovered in 2003 and 2004. In 2003, a small colony was found near the site of the new security gate for Naval Base Guam. A smaller colony was found in 2004 along the Lonfit River, near the Ordot landfill (B. Smith, UoG, pers. comm. 2006 as cited in USFWS 2012d). In 2009, a colony of Guam tree snails was discovered at the Ylig bridge replacement site near Yona (Guam Department of Public Works 2010). In a 2011 survey of Anderson AFB, a single colony of Guam tree snail was found (Janeke 2011 as cited in USFWS 2012d).

Fragile Tree Snail

The fragile tree snail is the only member of its genus to occur outside southeastern Polynesia (Smith et al. 2008). This species was originally considered widespread, but uncommon on the islands of Guam and Rota. Currently, there are five sites that support fragile tree snails: four sites on Guam on DoD lands and one site on privately owned land on Rota (USFWS 2012e).

In 1989, the fragile tree snail was regarded as the least abundant of the three partulids on Guam (Smith and Hopper 1994). Not seen on Guam since 1996, this species was observed in the Puga Point region in 2008 (Smith et al. 2008), in the Guatali-Atantano region in 2012 (SWCA 2012b), and a single colony was found in 2011 surveys of Andersen AFB (Janeke 2011 as cited in USFWS 2012e).

Mariana Eight-spot Butterfly

Caterpillars of the butterfly species feed on host plants found in primary limestone forest or other limestone habitat. Known host plants are two species in the Urticaceae family: *Elatostema calcareum* and *Procris pedunculata* (Schreiner and Nafus 1997).

Of the 10 known populations of this butterfly on Guam, 3 are on privately owned lands, 1 is on GovGuam lands, and 6 are on DoD lands (USFWS 2012f). An adult eight-spot butterfly was discovered in July 2009 during surveys of the Pagat/Route 15 area (Campora and Lee 2009). In 2011, five individual adult butterflies and larvae and eggs were found in areas where the host plant was present (Janeke 2011 as cited in USFWS 2012f). In July 2011, one adult male, one adult female, and nine eggs were located on various types of *Procris* near the Route 15 Guam International Raceway (Rubinoff and Kawahara 2011 as cited in USFWS 2012f).

2.0 METHODOLOGY

2.1 DESCRIPTION OF WORK

2.1.1 Transects and Survey Points

Areas that were surveyed are associated with the proposed LFTRC in two areas: NMS and PLS, southeast of NMS (Figure 1-1). Proposed range layouts shown in this report are Version 2.0, current as of November 2012; range locations are subject to future revisions. The areas covered by proposed range footprints and 100-m buffers around each range are shown in Figure 2-1 (for NMS) and Figure 2-2 (for PLS) and the sizes of these ranges are listed in Table 2-1. Depending on the resource being assessed (see below), 100-m buffers from the perimeter of the proposed range footprints may also be included in a resource-specific survey.

Table 2-1. Proposed Area of Live-Fire Training Ranges

Range	Footprint Area (acres [ha])	Buffer Area (acres [ha])	Total (acres [ha])
HG	1.5 (0.6)	16.1 (6.5)	17.6 (7.1)
KDP	0.8 (0.3)	13.3 (5.4)	14.1 (5.7)
KDR	20.3 (8.2)	41.3 (16.7)	61.5 (24.9)
MPMG	62.7 (25.4)	72.5 (29.3)	135.2 (54.7)
MRF	9.5 (3.8)	28.1 (11.4)	37.6 (15.2)
NSSA	2.4 (1.0)	17.6 (7.1)	20.0 (8.1)
Total	97.2 (39.3)	188.9 (76.4)	286.0 (115.7)

Notes: Individual numbers may not add to an exact total value due to rounding; ha = hectares.

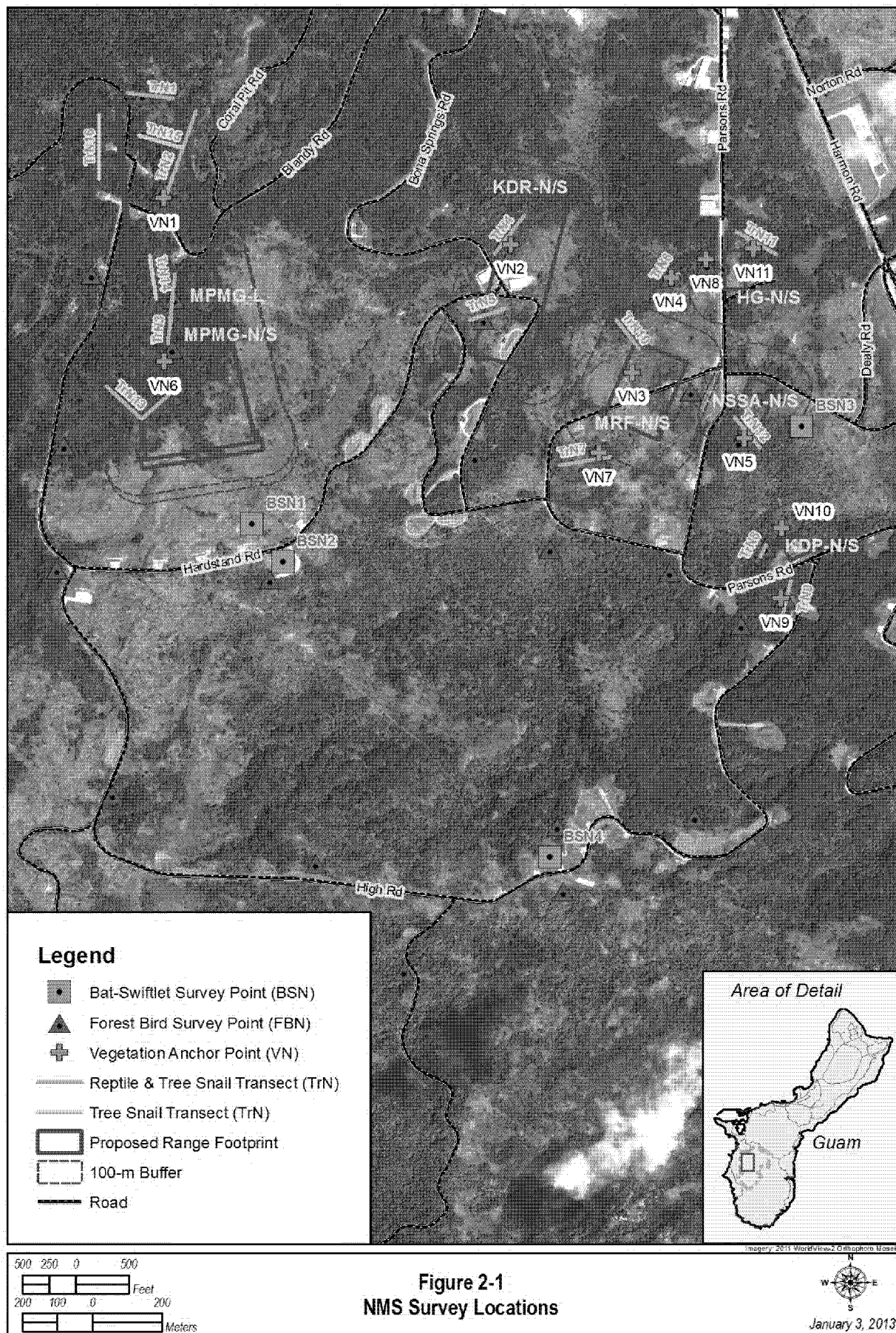
In this report range, layouts are identified by the proposed designators N/S, L, or E/W and every proposed range footprint has one of these unique identifiers.

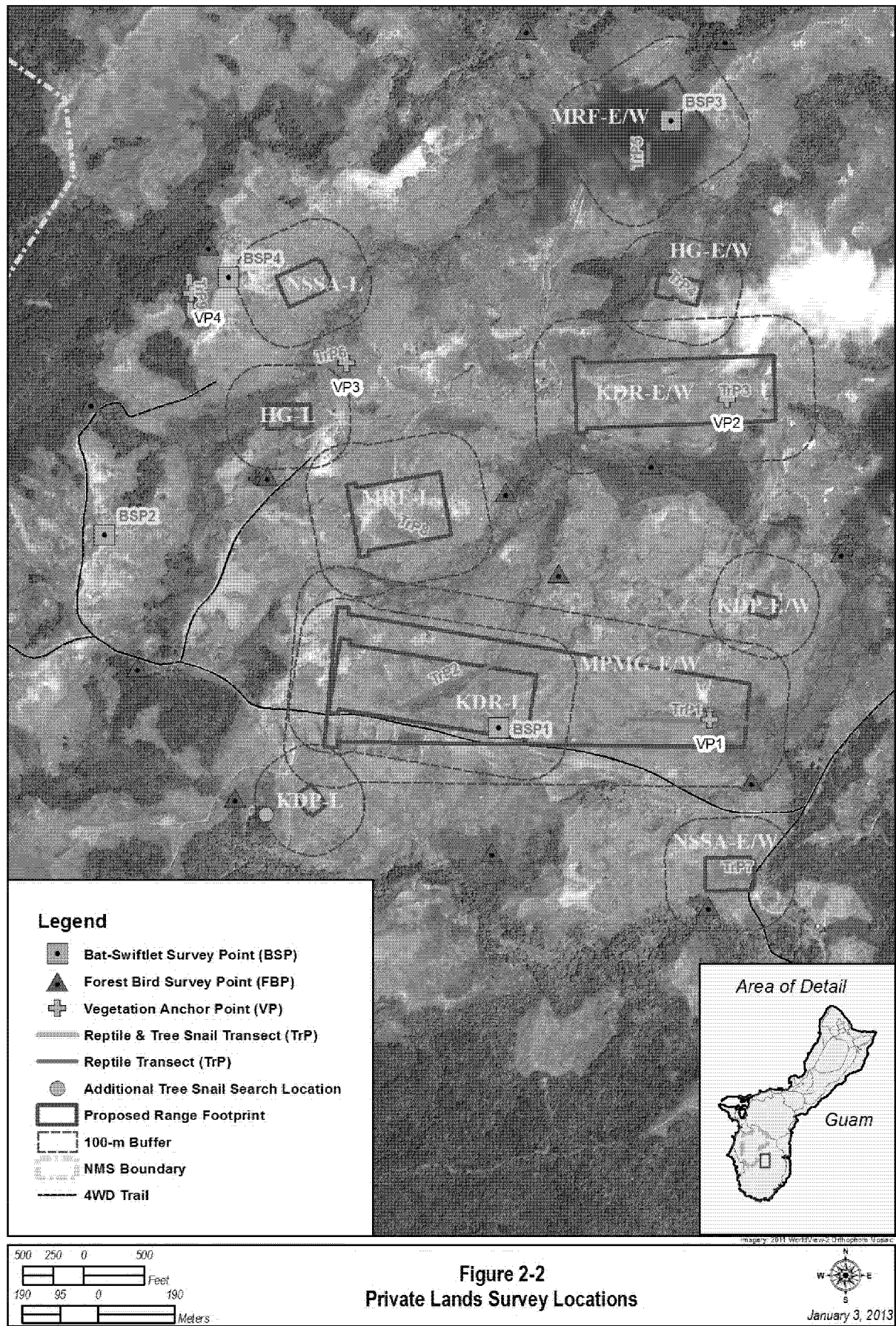
2.1.2 Species Surveys and Survey Team

JV biologists (Table 2-2) conducted field surveys of the following biological resources:

- Vegetation
- Federal ESA- and Guam-listed endangered plant species
- Guam SOGCN plant species
- Host plants for the ESA candidate species Mariana eight-spot butterfly
- Forest birds protected under the MBTA
- Guam-listed endangered reptiles
- Federal ESA-listed endangered wildlife species including Mariana common moorhen, Mariana fruit bat, and Mariana swiftlet
- ESA candidate and Guam-listed threatened and endangered tree snails

Survey areas for all plants, reptiles, and tree snails were within the proposed range footprints and associated 100-m buffer areas. Survey areas and stations for the birds and fruit bats were selected to include these areas plus areas within or overlooking potential SDZs. A summary of surveys conducted is provided in Table 2-3.





Aerial imagery used to assist in the vegetation mapping and shown in report figures is a 2011 WorldView-2 Orthophoto Mosaic of Guam with a 60-cm ground resolution.

Table 2-2. Survey Team

Role	Personnel
Project Manager	<ul style="list-style-type: none"> • Glenn Metzler (Cardno TEC Inc.), MS Biology
Vegetation Surveys	<ul style="list-style-type: none"> • Glenn Metzler (Cardno TEC, Inc.) – Lead • Karen Breitlow (Cardno TEC Inc.), MS Biological Sciences • Claudine Camacho (Duenas, Camacho, and Associates [DCA]), BA Biology • Bill Whitman (Cardno TEC Inc.), BA Environmental Studies
Forest Bird and Moorhen Surveys	<ul style="list-style-type: none"> • Rick Spaulding (Cardno TEC Inc.), MS Wildlife and Fisheries Science – Lead • Barbie Blann (AECOM), MS Environmental-Agricultural Education • Melissa Tu, (Cardno TEC Inc.), BA Environmental Biology
Reptile Surveys	<ul style="list-style-type: none"> • Michelle Christy (SWCA), PhD Conservation Biology – Lead • Nathan Johnson (SWCA), MS Wildlife Science • Pete Reynolds (SWCA), BS coursework, Forestry • Ken Cochrane (SWCA), MS Environmental Studies • Rachel Hansen (SWCA), MS Zoology
Tree Snail Surveys	<ul style="list-style-type: none"> • Nathan Johnson (SWCA) – Lead • Michelle Christy (SWCA) • Pete Reynolds (SWCA) • Ken Cochrane (SWCA) • Rachel Hansen (SWCA)
Fruit Bat and Swiftlet Surveys	<ul style="list-style-type: none"> • Nathan Johnson (SWCA) – Co-lead • Rick Spaulding (Cardno TEC Inc.) – Co-lead • Melissa Tu, (Cardno TEC) • Barbie Blann (AECOM) • Nathan Johnson (SWCA) • Pete Reynolds (SWCA) • Ken Cochrane (SWCA) • Rachel Hansen (SWCA)

Table 2-3. Biological Survey Types and Quantities

Survey Type	NMS	PLS
Vegetation Anchor Points	11	4
Mariana Fruit Bat and Mariana Swiftlet Points	4	4
Forest Bird Survey Points	27	15
Tree Snail Transects	16 7,900 ft (2,400 m)	1 330 ft (100 m)
Reptile Transects	13 6,700 ft (2,000 m)	9 3,800 ft (1,150 m)
Vegetation Mapping and Special-Status and Rare Species Surveys (targeted meandering surveys)	All ranges	All ranges
Moorhen Surveys	MPMG, MRF	None

An overview of each resource survey method is provided in the sections below. Detailed survey methods are described in each of the specialist reports found in the appendices.

2.2 VEGETATION SURVEYS

2.2.1 Vegetation Mapping

Vegetation was surveyed within proposed range footprints and associated 100-m buffer areas in May 2012 using a meandering reconnaissance survey method. The principal purpose of the survey was to determine whether, in limestone areas, vegetation was primary (relatively undisturbed) limestone vegetation or secondary (disturbed, either cleared previously or substantially altered) limestone vegetation and to determine if any of the unique *Merrilliodendron* forest type was present. In addition to these determinations, the survey evaluated the general vegetation types. The final categories used to map vegetation were as follows:

- Primary limestone forest - Relatively undisturbed (never cleared) forest dominated by native species.
- Secondary limestone forest - Degraded limestone forest resulting from clearing, encroachment by invasive species, fire, or other disturbance. Often dominated by woody species of relatively short stature (no canopy), or with a canopy of non-native *Vitex parviflora*.
- Secondary ravine forest - Forest vegetation in valleys and ravines in southern Guam and variable in floristic composition; heavily invaded by invasive plants and understory disturbed by feral ungulates.
- Forested wetland - Wetland areas dominated by woody vegetation.
- Savanna complex - Grasslands with scattered trees or clumps of trees. Predominantly on highly weathered volcanic soils and maintained by fire.
- Herbaceous wetland - Wetland areas dominated by herbaceous vegetation.
- Mixed herbaceous-scrub - A mix of grasslands and native or non-native woody scrub vegetation.
- Barren - Areas of bare volcanic soils devoid of plant cover in southern Guam.
- Developed - Areas heavily altered and maintained by man.

2.2.2 Quantitative Vegetation Analysis

Vegetation was evaluated along four 50-m transects oriented in the four cardinal directions emanating from a single point (anchor point), hereafter referred to as anchor point sampling. Surveys included point-quarter measurements and estimates of canopy cover for trees, point-quarter measurements of large herbaceous plants, ground cover quantitative analysis, and seedling counts. The surveys at NMS were conducted May 7-17, 2012, and the surveys at the PLS were conducted June 11-15, 2012. Survey personnel are listed in Table 2-2. Further details regarding the vegetation surveys can be found in Appendix A, *Vegetation Survey Report*.

2.2.3 Special-Status Plant Species and Mariana Eight-Spot Butterfly Host Plants

Surveys for special-status plants and Mariana eight-spot butterfly host plants were conducted throughout the proposed range footprints and associated 100-m buffers in habitat likely to support the target species. These surveys were conducted concurrently with meandering reconnaissance surveys for vegetation mapping. Species targeted include those listed in Table 1-1, as well as the butterfly host plants *Elatostema calcareum* and *Procris pedunculata*. In addition, host plants were examined for eight-spot butterfly eggs and larvae, and adult butterflies in the area of host plants were observed to determine species.

2.3 MARIANA FRUIT BAT AND MARIANA SWIFTLET

Station count surveys for Mariana fruit bats and Mariana swiftlets were conducted on six separate occasions at four locations each at NMS and the PLS to determine presence of the species, numbers of individuals using the proposed range locations, behavior while in the area, and flight paths. Locations were selected to give the best overlook coverage of the proposed ranges, SDZs, and adjacent areas. Further details regarding the fruit bat and swiftlet survey methodology can be found in Appendix B, *Mariana Fruit Bat and Mariana Swiftlet Survey Report*.

2.4 AVIAN SURVEYS

One-time point count surveys for MBTA species were conducted at the proposed range locations and within SDZs and other adjacent areas. In addition, Mariana common moorhen surveys were conducted in two bodies of water on NMS identified during preliminary aerial imagery evaluation and field verification. Water bodies or wetlands of interest for moorhen surveys were restricted to those within proposed range footprints and 100-m buffers. Further details regarding the avian survey methodology can be found in Appendix C, *Avian Survey Report*.

2.5 REPTILE SURVEYS

Reptile surveys were conducted nocturnally (targeting geckos) and diurnally (targeting skinks) on each transect. Species were documented by capture using glue board traps and/or visual surveys. Capturing individuals was valuable for identification of fast moving, cryptic or morphologically similar species. Visual surveys were intended to detect species that might not be trapped. Further details regarding the reptile survey methodology can be found in Appendix D, *Herpetological Survey Report*.

2.6 TREE SNAIL SURVEYS

Three survey methods were used to determine the presence, distribution, and abundance of special-status partulid tree snail species at a survey location: general visual surveys, detailed visual surveys, and quadrat surveys. These methods were specifically designed to target partulid tree snails and were adapted from those utilized in previous tree snail assessments (Hopper and Smith 1992; Smith et al. 2008). General visual surveys were conducted along all transects within forest habitat. Detailed visual surveys were then conducted along those transects that were determined to contain appropriate host plant species and habitat. The detailed surveys did not locate any living special-status tree snails, thus no quadrat surveys were conducted. Additional details of survey methodology are included in Appendix E, *Tree Snail Survey Report*. In addition to these surveys, careful observations were made for tree snails on potential host plants in habitat likely to support tree snails during vegetation mapping surveys.

3.0 NAVAL MAGAZINE SITE

3.1 VEGETATION SURVEYS

3.1.1 Vegetation Mapping

The major vegetation types within each proposed NMS range are shown in the photos in Figure 3-1. Mapped vegetation types for each of the proposed ranges are shown in Figure 3-2. The area of vegetation types within each surveyed range is provided in Table 3-1, and Figure 3-3 graphically summarizes the data.

Descriptive summaries of the vegetation types observed within each proposed range are provided below. Plant species described in these discussions are either native (indigenous or endemic to Guam; abbreviated as N in Figure 3-4) or introduced from places outside of Guam (abbreviated as I in Figure 3-4).

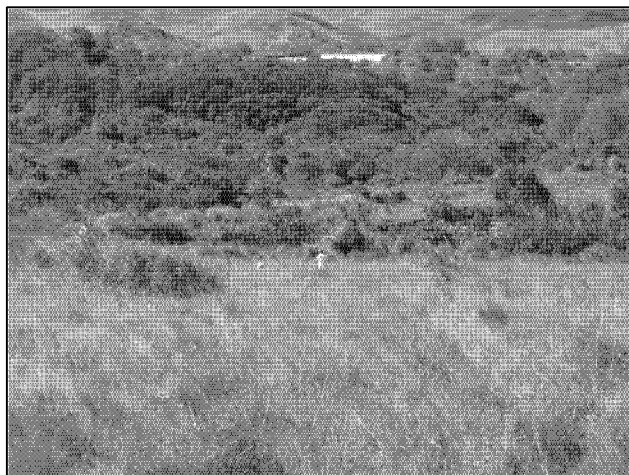
Figure 3-1. Photos of Representative Vegetation Types within the Proposed NMS Ranges



KDR-N/S



KDR-N/S



MRF-N/S



KDP-N/S

Figure 3-1. Photos of Representative Vegetation Types within the Proposed NMS Ranges



MPMG-N/S and MPMG-L, North of Blandy Road (Rd)
(also representative of some areas south of Blandy Rd)



MPMG-N/S and MPMG-L, South of Blandy Rd
(also representative of some areas north of Blandy Rd)



HG-N/S



NSSA-N/S

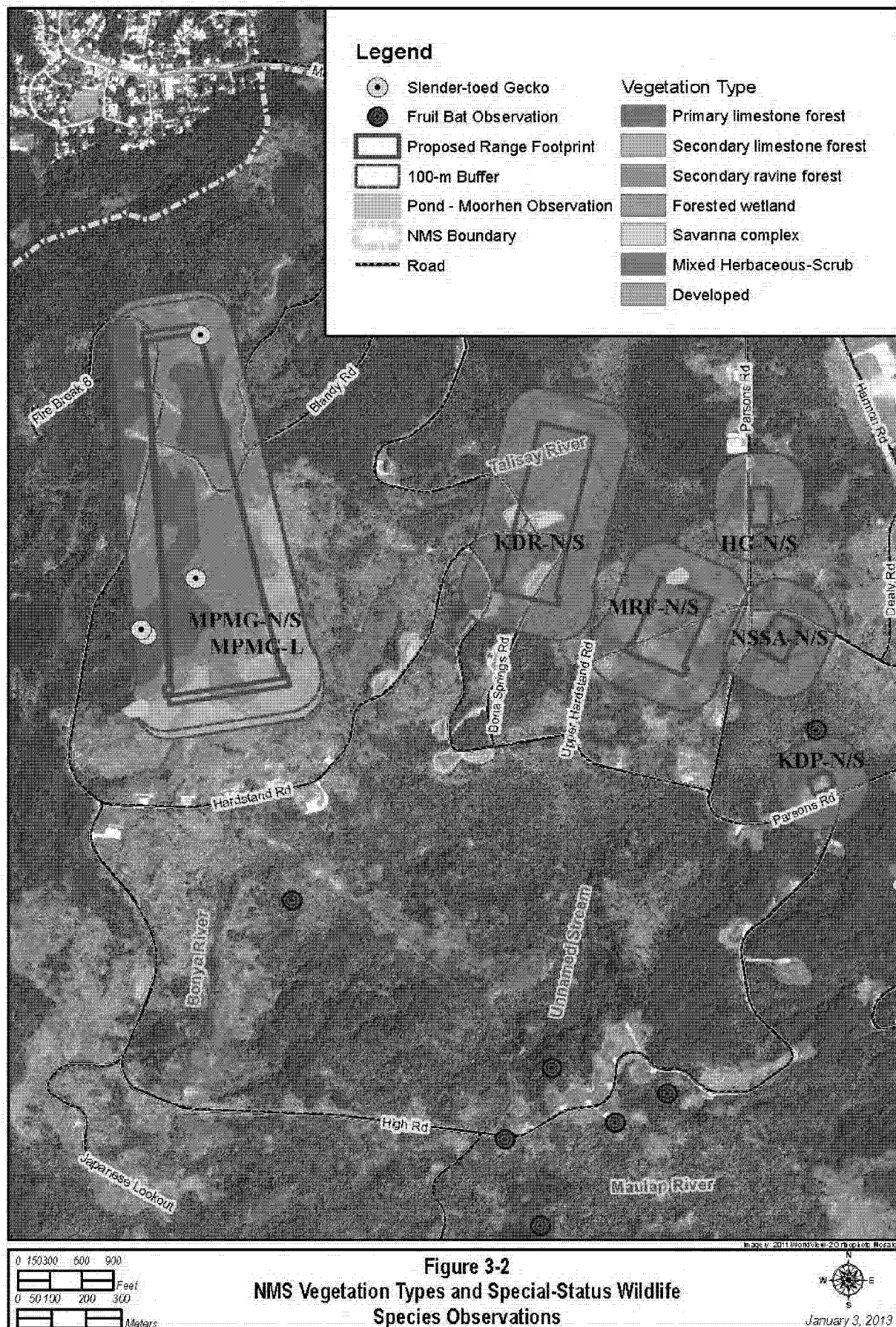
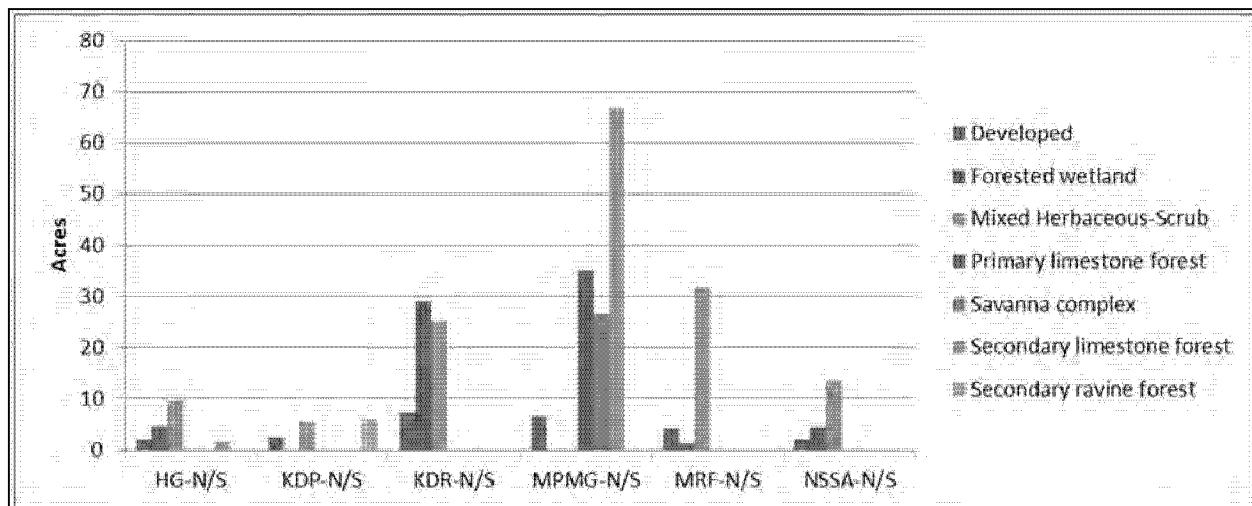


Table 3-1. Vegetation Types Within the Proposed NMS Ranges in the N/S & L Configurations

Vegetation Type Location	Vegetation Area (acres) by Range						Total
	HG- N/S	KDP- N/S	KDR- N/S	MPMG- N/S and L	NSSA- N/S	MRF- N/S	
Primary Limestone Forest	-	-	-	35.1	-	-	35
Range Footprint	-	-	-	19.6	-	-	19.6
100-m Buffer	-	-	-	15.5	-	-	15.5
Secondary Limestone Forest	1.5	-	-	66.8	-	-	68
Range Footprint	-	-	-	35.5	-	-	35.5
100-m Buffer	1.5	-	-	31.3	-	-	32.8
Secondary Ravine Forest	-	6.1	-	-	-	-	6.1
Range Footprint	-	0.3	-	-	-	-	0.3
100-m Buffer	-	5.7	-	-	-	-	5.7
Forested Wetland	4.6	-	29.1	-	4.5	1.3	40
Range Footprint	-	-	7.2	-	-	-	7.2
100-m Buffer	4.6	-	21.9	-	4.5	1.3	32.3
Mixed Herbaceous-Scrub	9.5	5.6	25.0	-	13.6	31.8	85
Range Footprint	1.4	-	9.0	-	2.4	8.0	20.8
100-m Buffer	-	5.6	16.0	-	11.2	23.8	64.6
Savanna Complex	-	-	-	26.6	-	-	27
Range Footprint	-	-	-	4.6	-	-	4.6
100-m Buffer	-	-	-	21.9	-	-	21.9
Open Water	-	-	-	0.2	-	0.2	<1
Range Footprint	-	-	-	-	-	-	0.0
100-m Buffer	-	-	-	0.2	-	0.2	0.4
Developed	2.0	2.4	7.3	6.6	1.9	4.2	25
Range Footprint	0.1	0.5	4.0	3.0	-	1.5	9.1
100-m Buffer	1.9	1.9	3.3	3.6	1.9	2.8	15.4
Total	18	14	61	135	20	38	286

Note: Dash (-) indicates vegetation type was not observed or the acreage was less than 0.1.

Figure 3-3. Vegetation Types for the Proposed NMS N/S & L Range Configurations



Note: The MPMG-L configuration range has the same footprint as the MPMG-N/S range configuration.

MPMG-N/S and MPMG-L Range

Approximately 26% or 35 of 135 acres (14 of 55 ha) of this proposed range is primary limestone forest (Table 3-1) growing on karst limestone. In some areas, the topography consists of pinnacle limestone with knife-edge ridges and deep crevasses up to 10 ft (3 m) deep. No *Merrilliodendron* forest was observed in these areas. An additional 67 acres (27 ha) is degraded secondary limestone forest that has either been cleared or substantially disturbed in the past. This secondary limestone forest determination was based on the presence of any one of the following vegetation conditions:

- Not dominated by native woody species
- Characterized by an open forest with no overstory canopy and a mix of native and non-native species
- Characterized by an overstory canopy dominated by the invasive tree *Vitex parviflora*

KDR-N/S Range

The proposed KDR-N/S range is an area of relatively flat terrain on volcanic substrate and the vegetation consists primarily of two wetland areas, a cleared field of non-native herbaceous vegetation, and developed land. The wetland area in the northern portion of the range is a forested wetland, much of it with standing water, dominated by native species but with the non-native palm *Areca catechu* also abundant. Disturbance by feral animals is lower in this habitat than in other forested areas with gentle terrain. The wetland in the southern portion of the range is a mix of open forest and open savanna.

MRF-N/S Range

The proposed MRF-N/S range is situated on flat or gently sloping terrain in an open field of grass and wetland-adapted herbaceous vegetation. Only a few scattered shrubs and trees are present in the proposed range footprint and 100-m buffer. The native, endemic grass *Dimeria chloridiformis* is common in patches within this range.

KDP-N/S Range

The proposed KDP-N/S range footprint is very small (0.8 acre [0.3 ha]) and completely within an area of maintained vegetation associated with one of the existing munitions storage areas. The buffer area of this proposed range extends into disturbed ravine forest with an overstory canopy of the invasive *Vitex parviflora*.

NSSA-N/S Range

The southern portion of the proposed NSSA-N/S range buffer area is a forested wetland. Tree species include *Pandanus tectorius*, *Hibiscus tiliaceus*, *Cocos nucifera*, and *Areca catechu*. Patches of the wetland fern *Acrosticum aureum* were noted. To the north of the forested wetland and into the proposed range footprint are areas of open sedge-grass wetland and other areas of mixed herbaceous-scrub. Vegetation outside the forested wetland portion of the proposed range buffer has been substantially disturbed.

HG-N/S Range

The proposed range footprint and the southwestern portion of the buffer area consist of degraded herbaceous-scrub vegetation. Vegetation in the northern part of the buffer area is largely forest wetland vegetation and is dominated by common trees such as *Pandanus tectorius* and *Hibiscus tiliaceus*. The

vegetation was more diverse west of Parsons Rd, where additional herbaceous and woody species were present. In the southeastern corner of the proposed range is mixed herbaceous-scrub vegetation with large areas of *Wedelia trilobata*, a non-native, invasive herb. Most of the proposed range has significant ungulate damage.

3.1.2 Quantitative Vegetation Analysis

The quantitative anchor point analysis revealed a variety of vegetation types. Table 3-2 summarizes some of the major findings of the analysis with emphasis on estimating the area of native vegetation, which is an indicator of the quality of the habitat or degree of degradation.

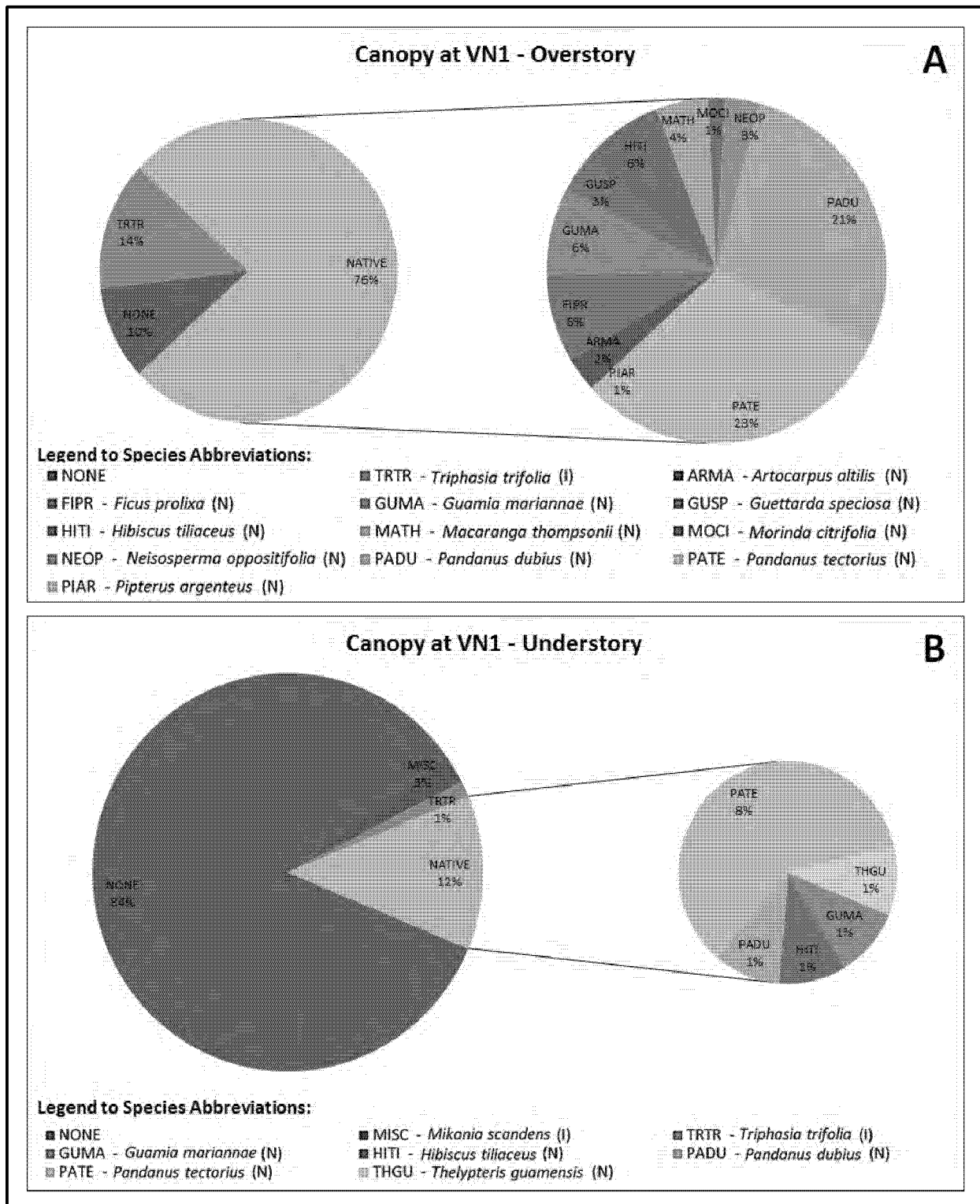
The analysis of the canopy coverage is a good representation of the vegetation character at each sampling location because the canopy, if there is one, is a reflection of the longer-term history and condition of the vegetation at a particular location. For example, if there is a large percentage of the invasive tree *Vitex parviflora* in the canopy, then it is very likely that the overall condition of all the vegetation at that location is poor. Figure 3-4 summarizes the species present in the canopy at each vegetation survey anchor point. These results support the summary in Table 3-2. Vegetation anchor point VN1 has the greatest canopy native species richness.

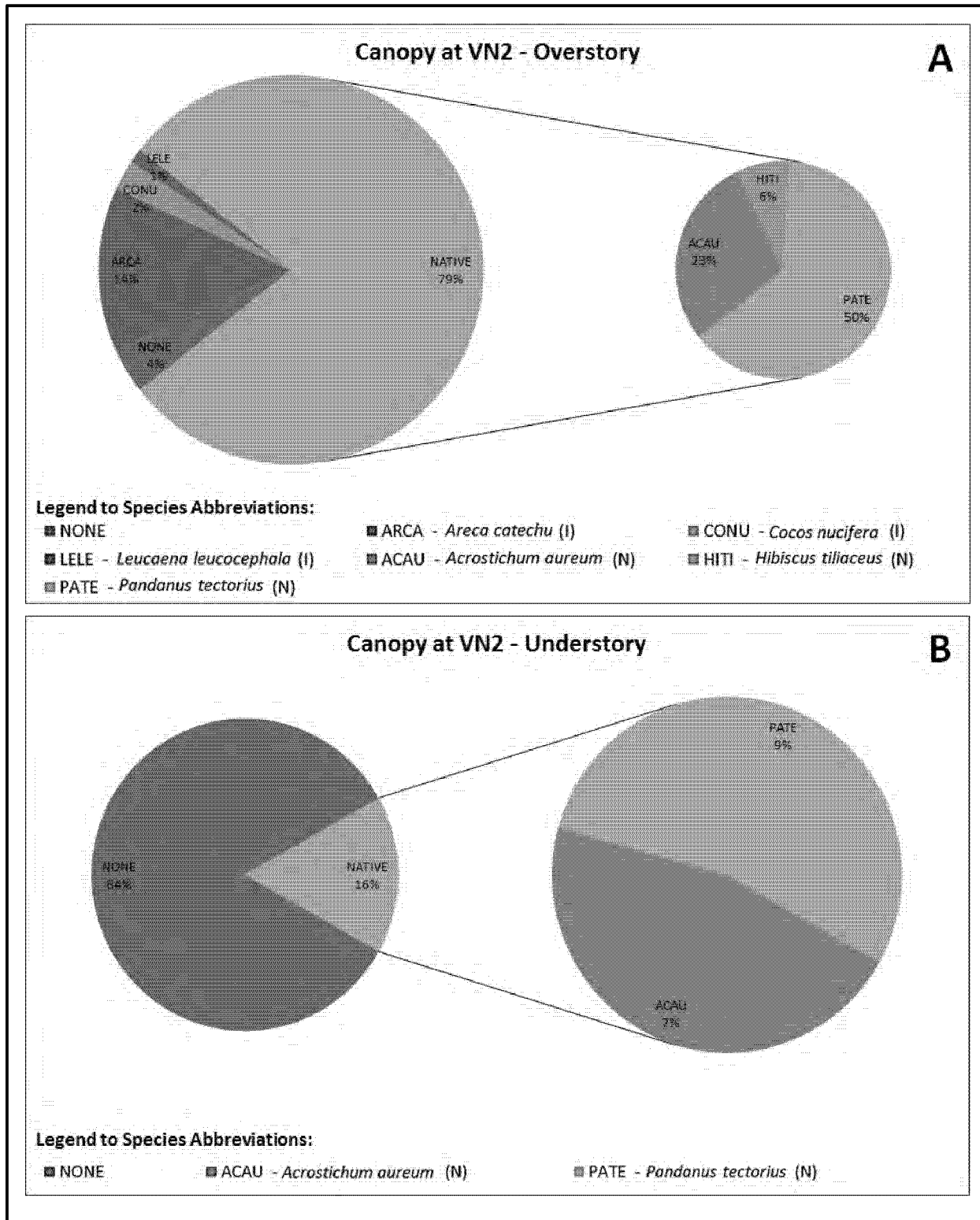
Table 3-2. Quantitative Vegetation Analysis Data Summary

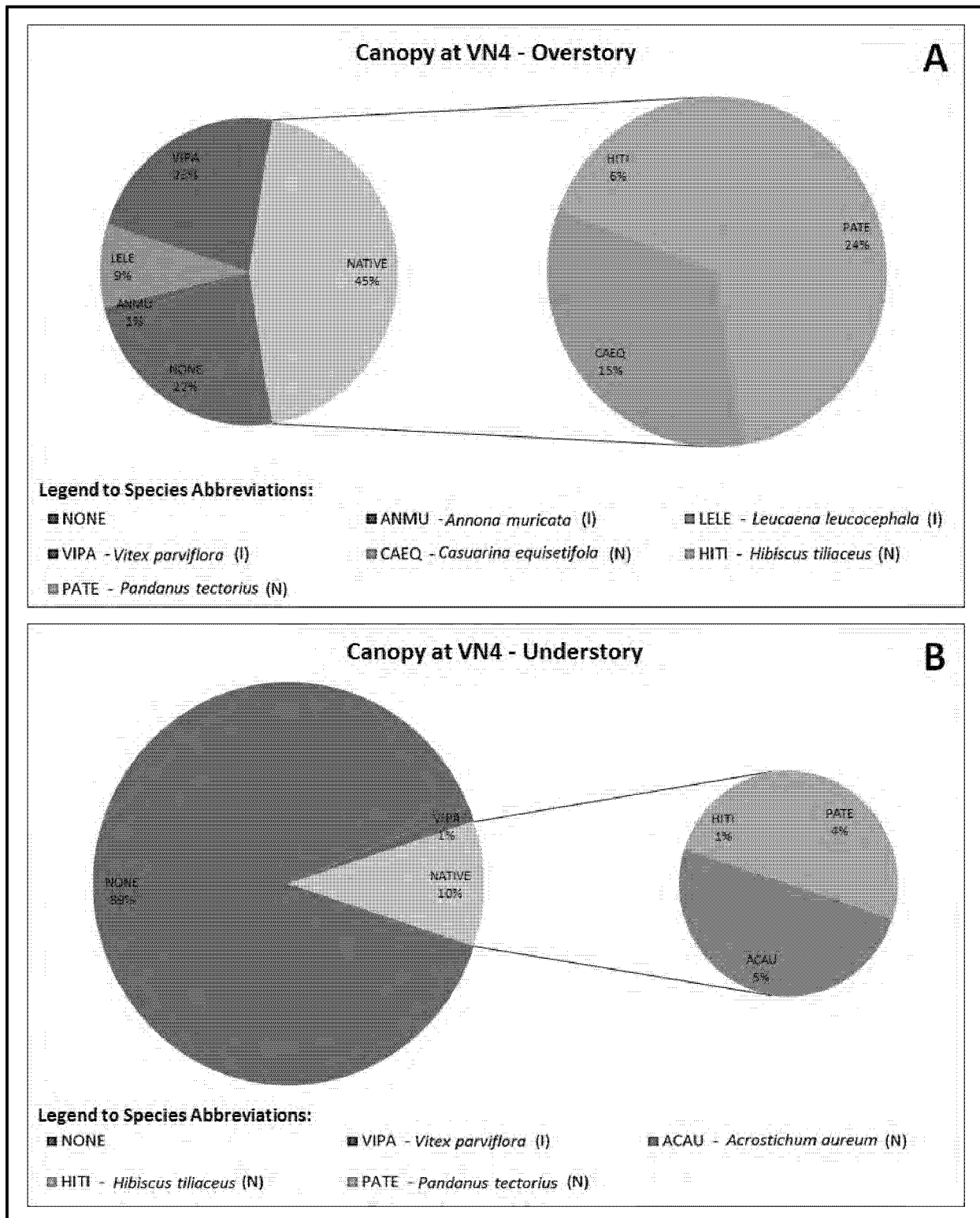
Anchor Point (Range)†	Vegetation Type	Canopy Overstory (% Native)	Canopy Understory (% Native)	Tree Basal Area Dom*	Tree Abundance Dom*	Herbaceous Plant Cover (% Native)	No. Woody Plant Seedlings
VN1 (MPMG)	Primary Limestone Forest	76	12	N	N	20	N: 17 I: 11
VN2 (KDR)	Forested Swamp	79	16	N	N	63	N: 0 I: 0
VN3 (MRF)	Mixed Herbaceous-Scrub	NA	NA	I	I	71	N: 0 I: 1
VN4 (HG)	Secondary Limestone Forest	45	10	N	N	24	N: 27 I: 38
VN5 (NSSA)	Forested Swamp	42	31	N	N	67	N: 16 I: 6
VN6 (MPMG)	Primary Limestone Forest	78	31	I	N	17	N: 87 I: 30
VN7 (MRF)	Mixed Herbaceous-Scrub	16	5	I	I	0	N: 70 I: 2
VN8 (HG)	Secondary Limestone Forest	35	10	N	N	56	N: 1 I: 0
VN9 (KDP)	Secondary Ravine Forest	32	15	I	N = I	45	N: 17 I: 41
VN10 (KDP)	Mixed Herbaceous-Scrub	19	4	N	N	50	N: 56 I: 44
VN11 (HG)	Mixed Herbaceous-Scrub, Forested Wetland	35	39	N	N	44	N: 84 I: 16

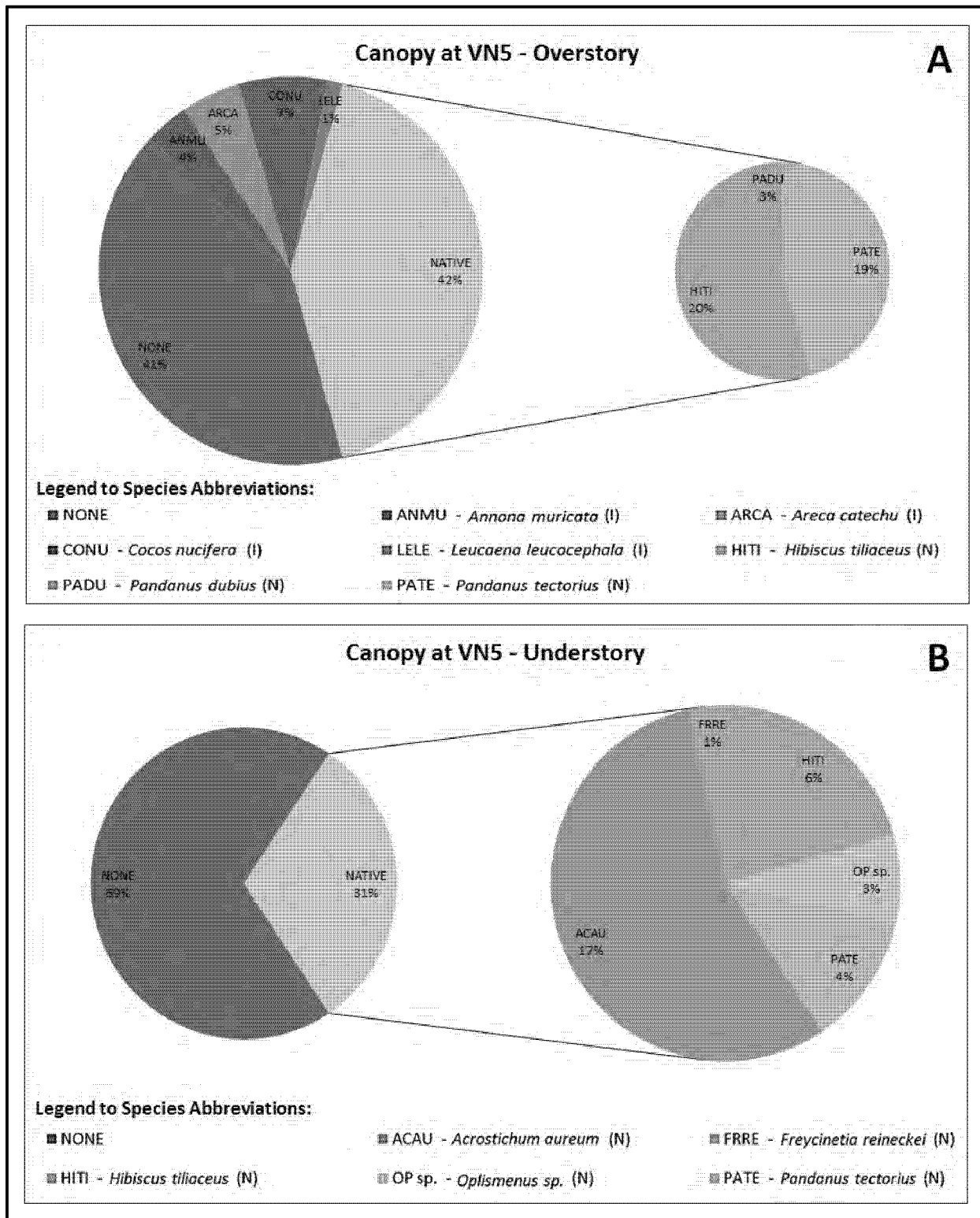
Notes: I = introduced or non-native; N = native; NA = not applicable; *Entries in these columns indicate whether the dominant plants (based on basal area or relative abundance) are primarily native (N) or introduced (I); †Anchor Points are depicted on Figure 2-1.

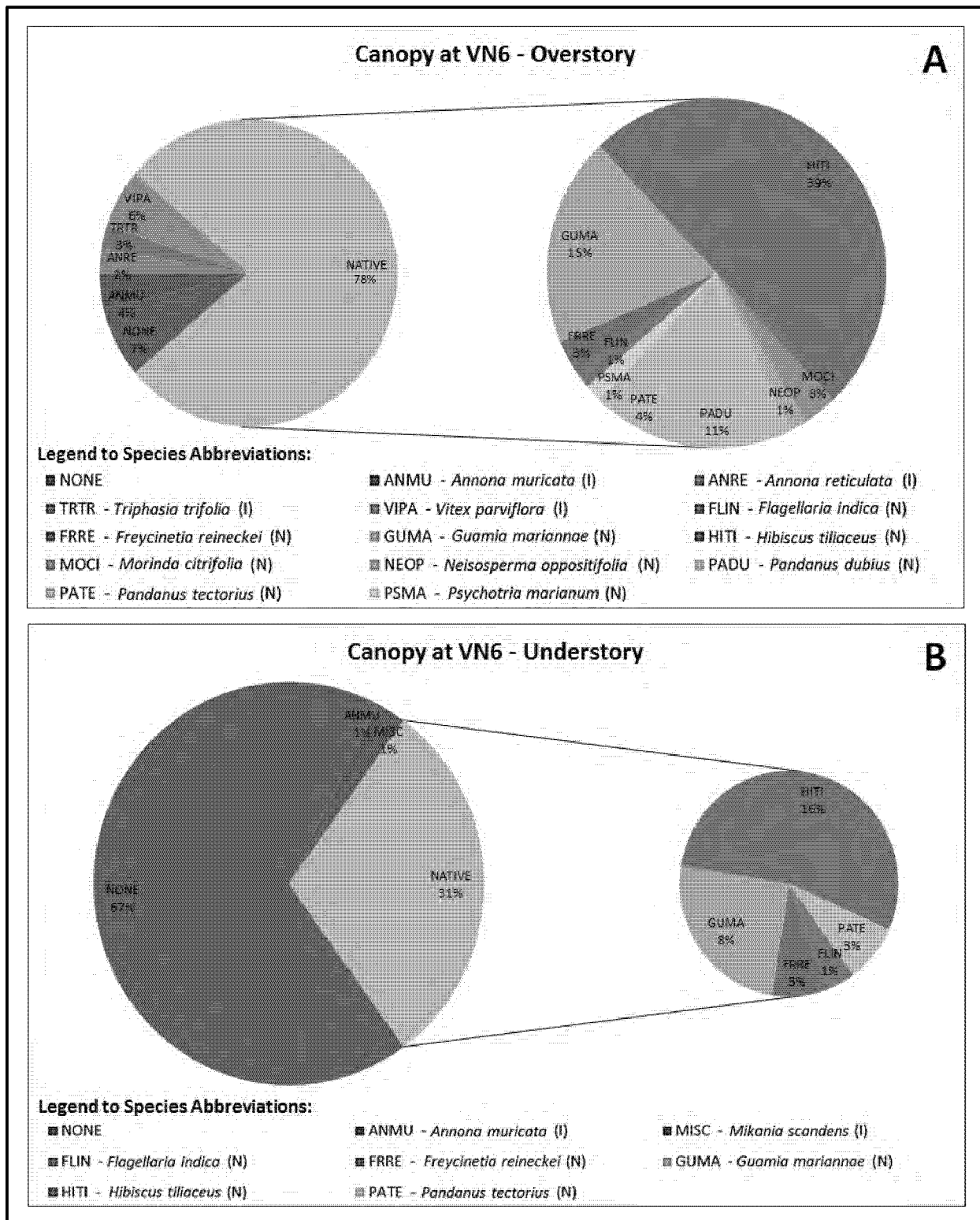
Figure 3-4. Evaluation of Canopy Vegetation at NMS Anchor Points

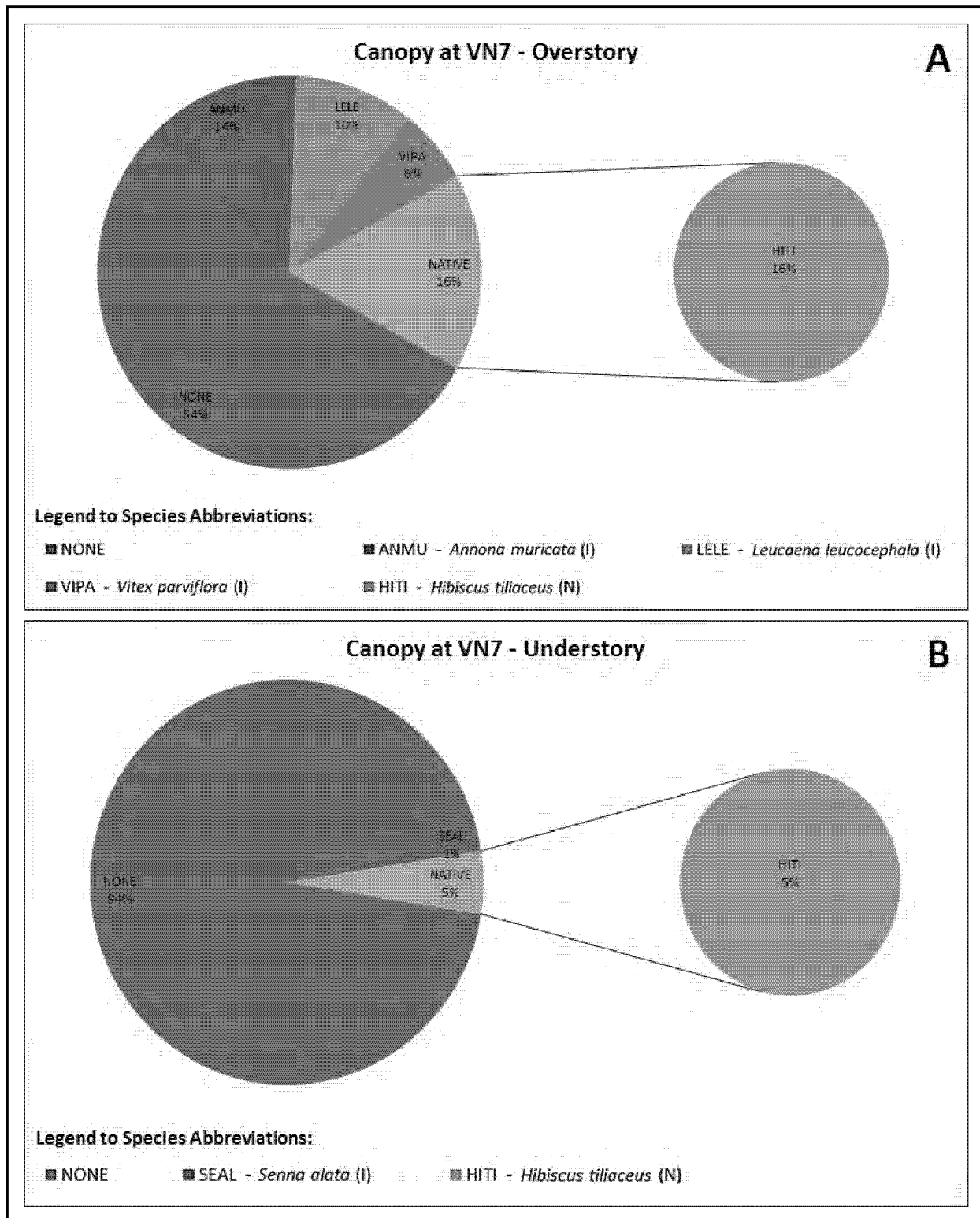


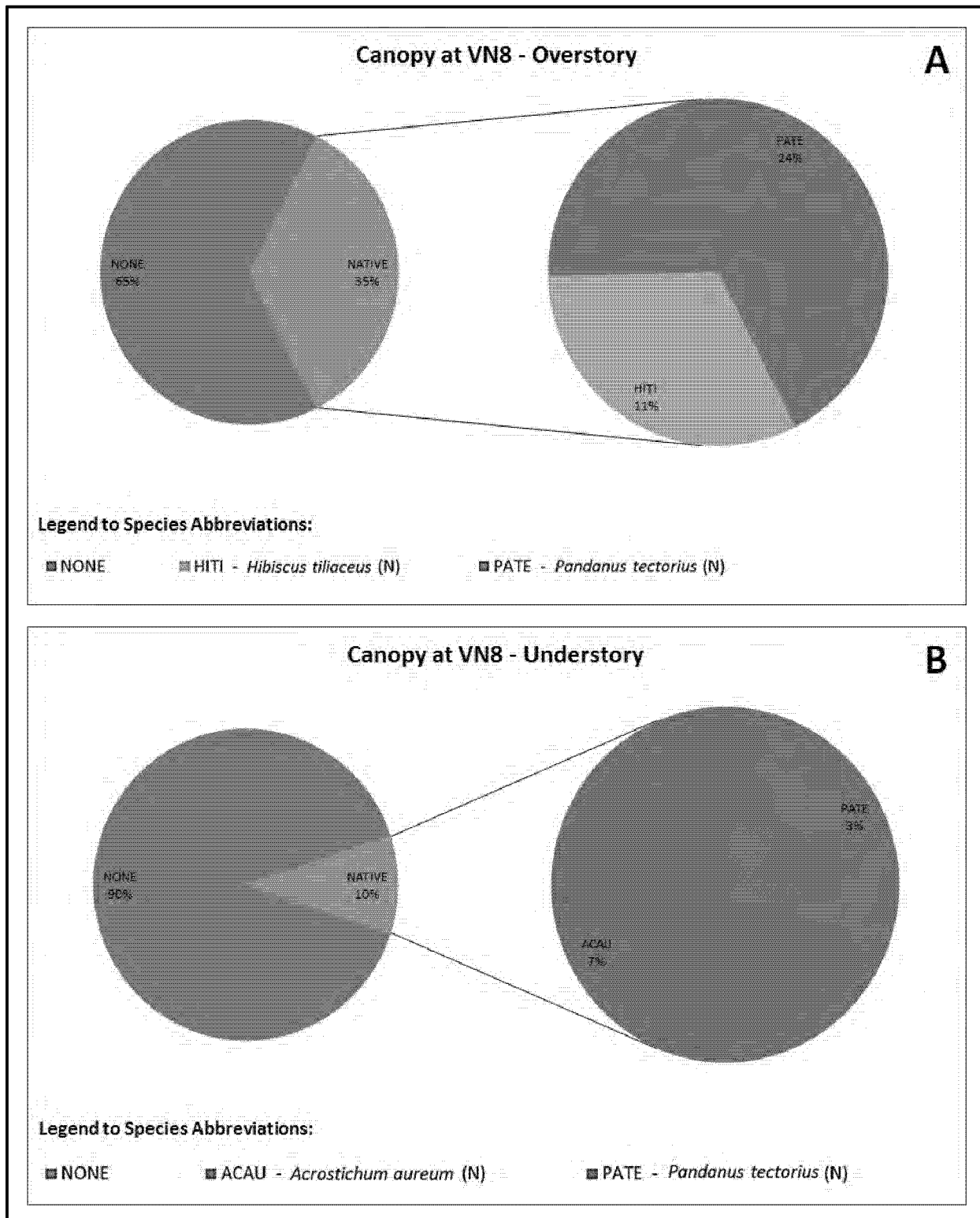


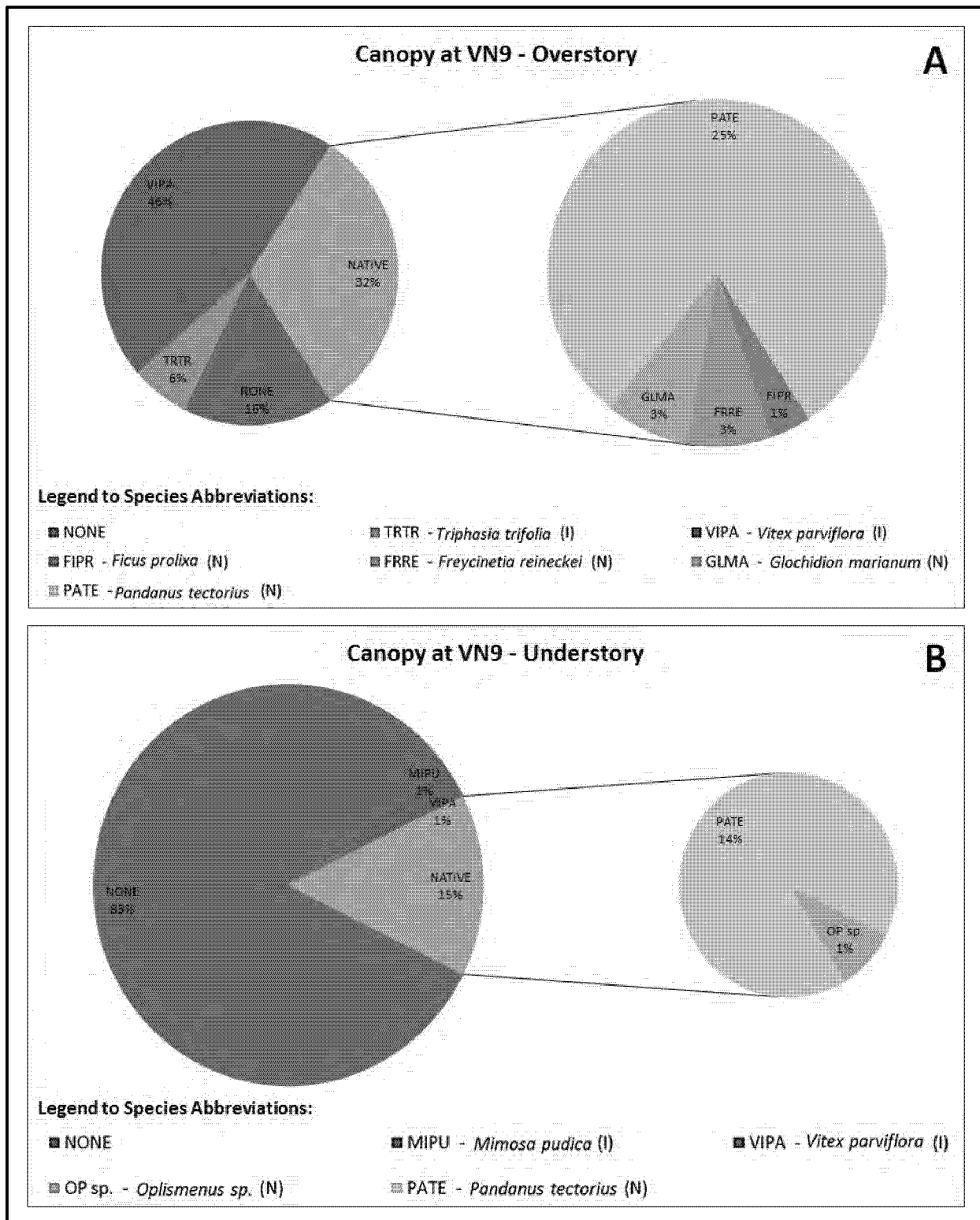


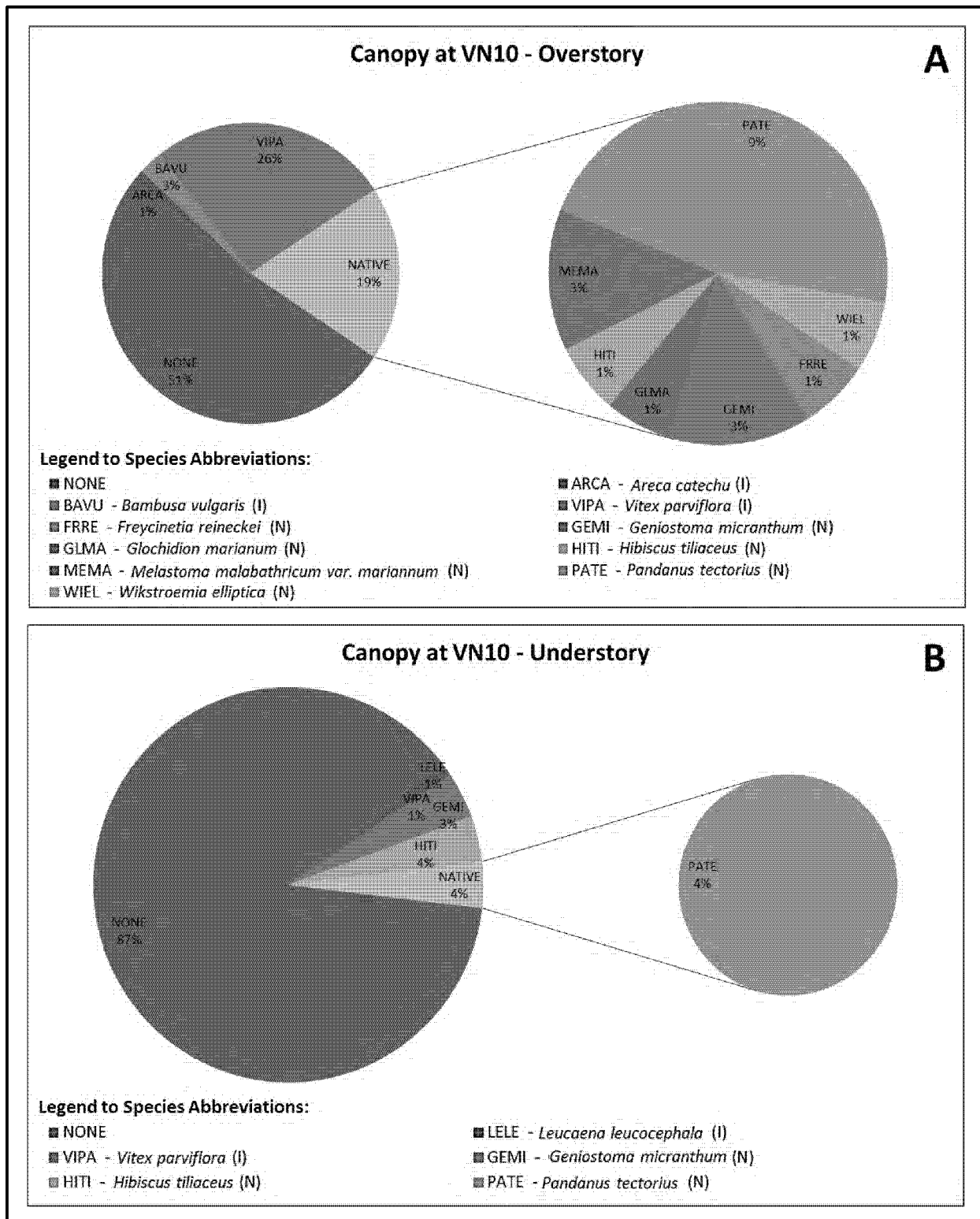


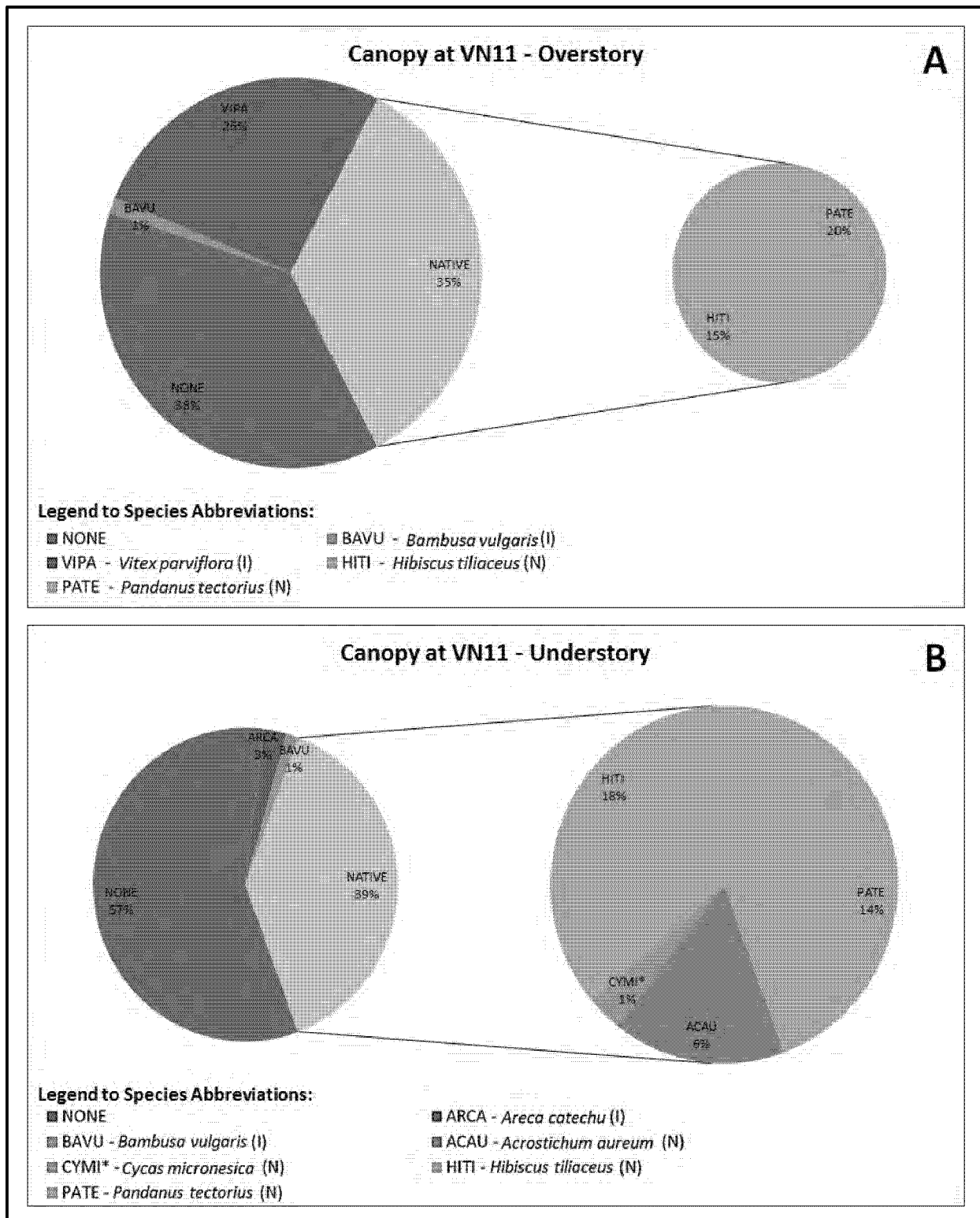












3.1.3 Special-Status Plant Species and Mariana Eight-Spot Butterfly Host Plants

Merrilliodendron megacarpum

Several patches of *Merrilliodendron megacarpum* were noted in the southwestern portion of the proposed MPMG range 100-m buffer along a general north-south trending line (Figure 3-5). These patches were small with the largest approximately 100 ft (30 m) in diameter and consisting of several dozen trees.

Tabernaemontana rotensis

A single specimen of the tree species *Tabernaemontana rotensis* was found within the western 100-m buffer of the proposed MPMG range (Figure 3-5).

Cycas micronesica

Cycads were found at seven scattered locations and also in a somewhat concentrated linear pattern along the southeast edge of the proposed MPMG range footprint (Figure 3-5), with an estimated 30-40 individuals observed. All live individuals encountered were in poor to fair condition with most showing signs of scale infestation.

Rare Plants

Three rare plant species that are not SOGCN were observed during surveys at a few locations: *Pisonia umbellifera*, *Fagraea berteriana* var. *ladronica*, and *Drypetes dolichocarpa* (Figure 3-5). These species are described in detail in Appendix A.

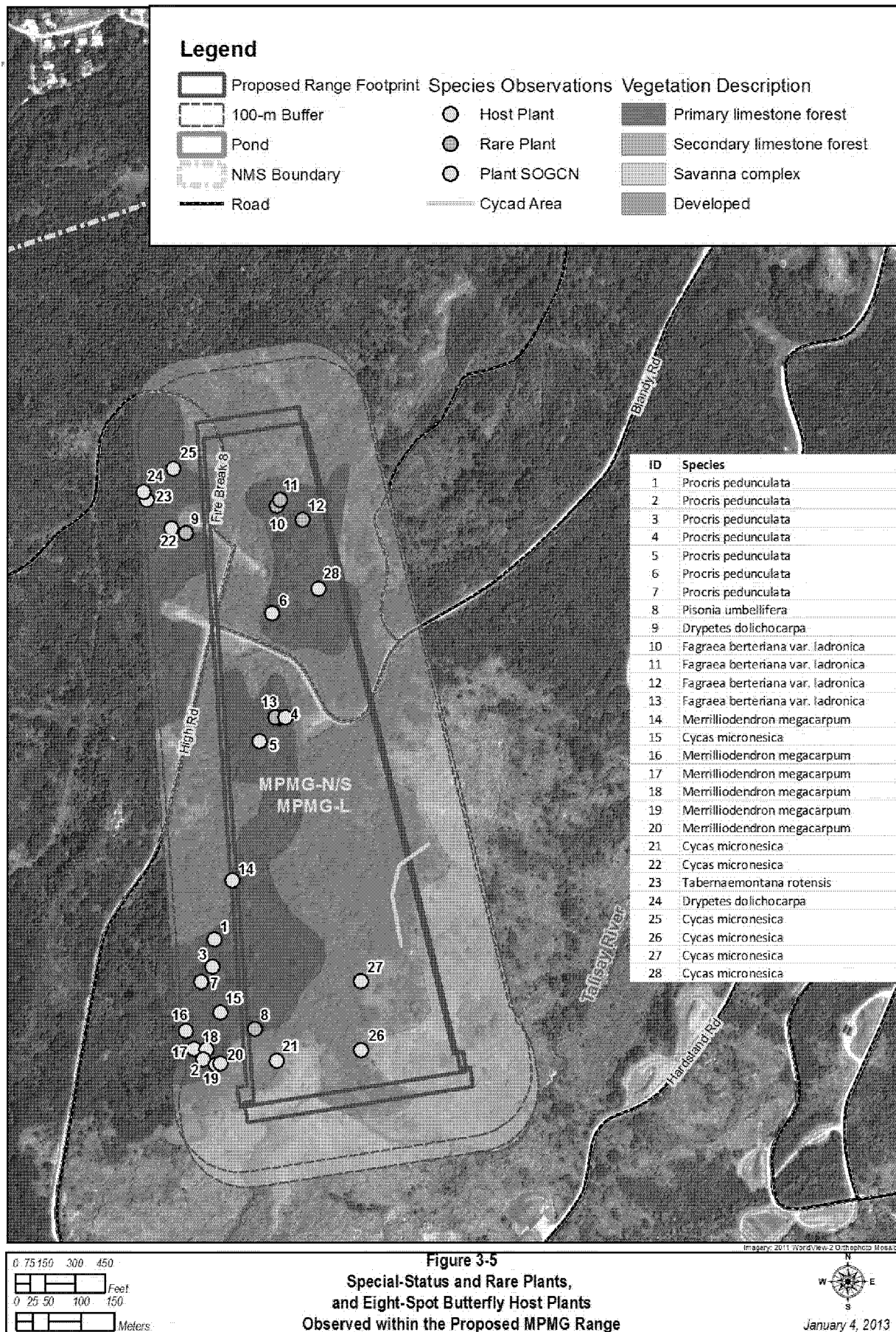
Butterfly Host Plants

The Mariana eight-spot butterfly host plant *Procris pedunculata* was observed in patches that were usually small (less than 25 ft [7.6 m] in diameter) at multiple locations within the proposed MPMG range 100-m buffer (Figure 3-5). One substantially larger patch of approximately 4,000 square ft (370 square m) was observed within the range footprint just south of Blandy Rd (Figure 3-5).

3.2 MARIANA FRUIT BAT AND MARIANA SWIFTLET SURVEYS

Seven detections of a single fruit bat on seven separate dates were recorded during surveys at four locations: one from station Bat-Swiftlet Observation Point-NMS 2 (BSN2), one from station BSN3, and five from station BSN4. The survey station locations are shown on Figure 2-1 and the estimated on-the-ground locations of the sightings are shown in Figure 3-2. It is not known how many individuals these observations represent as sightings could represent the same individual on different occasions or at different locations given their mobility. All observed fruit bats flew out of the observer's field of view, except the fruit bat recorded from station BSN3. For approximately 6 minutes, this fruit bat landed and subsequently roosted in *Cocos nucifera* trees before departing the region and out of the observer's field of view. All fruit bat observations occurred between 0530 and 0651 hours.

The Mariana swiftlet was not observed during the surveys at NMS.



3.3 AVIAN SURVEYS

A single endangered Mariana common moorhen was observed at each of two separate pond locations within the survey area (Figure 3-2). It could not be determined whether these observations represented more than one individual. No native or MBTA birds were detected during station surveys. Two native species listed under the MBTA were observed while transiting to and from overlook stations on NMS: yellow bittern (*Ixobrychus sinensis*) and white tern (*Gygis alba*).

3.4 REPTILE SURVEYS

Only one special-status reptile species was detected during the surveys at NMS. Two Pacific slender-toed geckos were detected at the proposed MPMG range on April 2, 2012 and three individuals were observed on November 26, 2012 (Figure 3-2).

3.5 TREE SNAIL SURVEYS

General and detailed visual surveys were conducted along 14 transects on NMS between March and November 2012 (Figure 2-1). Detailed visual surveys were conducted along Transects 1-4 and 9. The total survey length was 4,100 ft (1,250 m). No live partulid tree snails were observed during the surveys. Dead, bleached shells of the humped tree snail and Guam tree snail were observed while investigating leaf litter during detailed visual surveys along TrN2. Because no live partulid tree snails were observed during general or detailed visual surveys, no quadrat surveys were completed.

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4.0 PRIVATE LANDS SITE

4.1 VEGETATION SURVEYS

Meandering, targeted reconnaissance surveys were conducted throughout the proposed PLS live-fire training range footprints and associated 100-m buffers to evaluate vegetation.

4.1.1 Vegetation Mapping

The major vegetation types within each proposed PLS live-fire training range are shown in the photos in Figure 4-1. Mapped vegetation types for each of the proposed ranges are shown in Figure 4-2. The area of vegetation types within each surveyed proposed range is provided in Tables 4-1 and 4-2, and Figures 4-3 and 4-4 graphically summarize the data.

The entire area of the proposed ranges has been substantially altered by past uses, primarily agriculture. Large expanses of non-native grass interspersed with areas of barren soil are typical for the area. However, numerous wetlands dominated by native emergent herbaceous vegetation are found within this area.

Descriptive summaries of the vegetation types observed within each range are provided below. Plant species described in these discussions are either native (indigenous or endemic to Guam; abbreviated as N) or introduced from places outside of Guam (abbreviated as I).

Figure 4-1. Photos of Representative Vegetation Types within the Proposed PLS Ranges



MPMG-E/W and KDR-L



MPMG-E/W and KDR-L

Figure 4-1. Photos of Representative Vegetation Types within the Proposed PLS Ranges



MPMG-E/W and KDR-L (Bermed pond)



MPMG-E/W



HG-L



HG-L



NSSA-L



NSSA-E/W

Figure 4-1. Photos of Representative Vegetation Types within the Proposed PLS Ranges



KDP-L



KDP-E/W



HG-E/W



HG-E/W



MRF-E/W



KDR-E/W

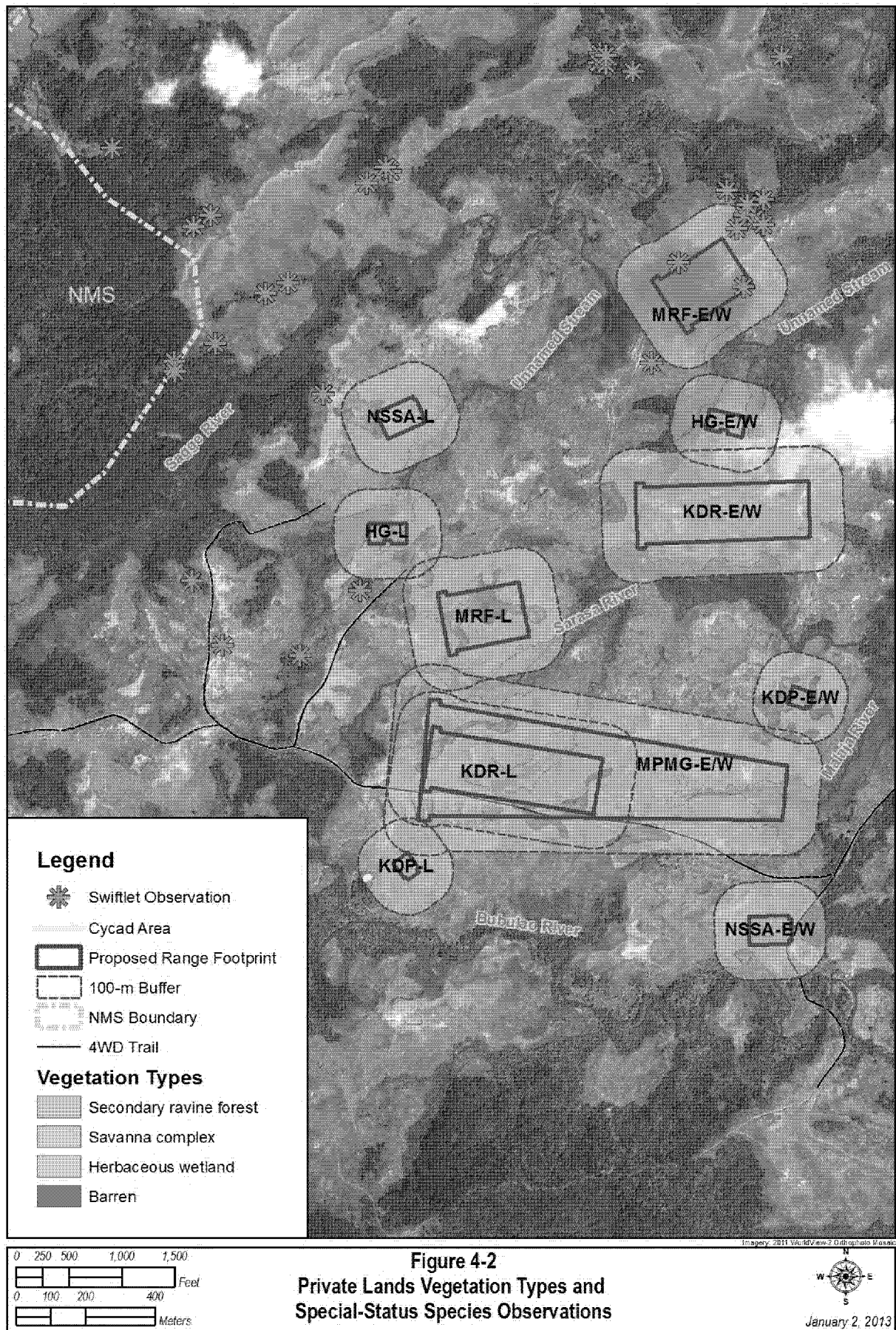


Table 4-1. Vegetation Types and Coverage within the Proposed PLS Ranges in the L Configuration

Vegetation Type Location	Vegetation Area (acres) by Range					
	HG-L	KDP-L	KDR-L	NSSA-L	MRF-L	Total
Secondary Ravine Forest	-	0.4	-	-	-	<1
Range Footprint	-	-	-	-	-	-
100-m Buffer	-	0.4	-	-	-	0.4
Savanna Complex	9.0	13.7	46.3	13.7	26.0	109
Range Footprint	0.8	0.8	14.5	2.4	5.8	24.3
100-m Buffer	8.2	12.9	31.8	11.3	20.2	84.4
Herbaceous Wetland	6.2	0.1	7.2	3.7	5.1	22
Range Footprint	0.8	-	4.1	-	-	4.9
100-m Buffer	5.4	0.1	3.1	3.7	5.1	17.4
Barren	2.5	-	8.0	2.6	6.4	20
Range Footprint	-	-	1.7	-	3.7	5.4
100-m Buffer	2.5	-	6.3	2.5	2.8	14.1
Total	18	14	62	20	37	151

Note: Dash (-) indicates vegetation type was not observed or the acreage was less than 0.1.

Figure 4-3. Vegetation Types for the Proposed PLS Ranges in the L Configuration

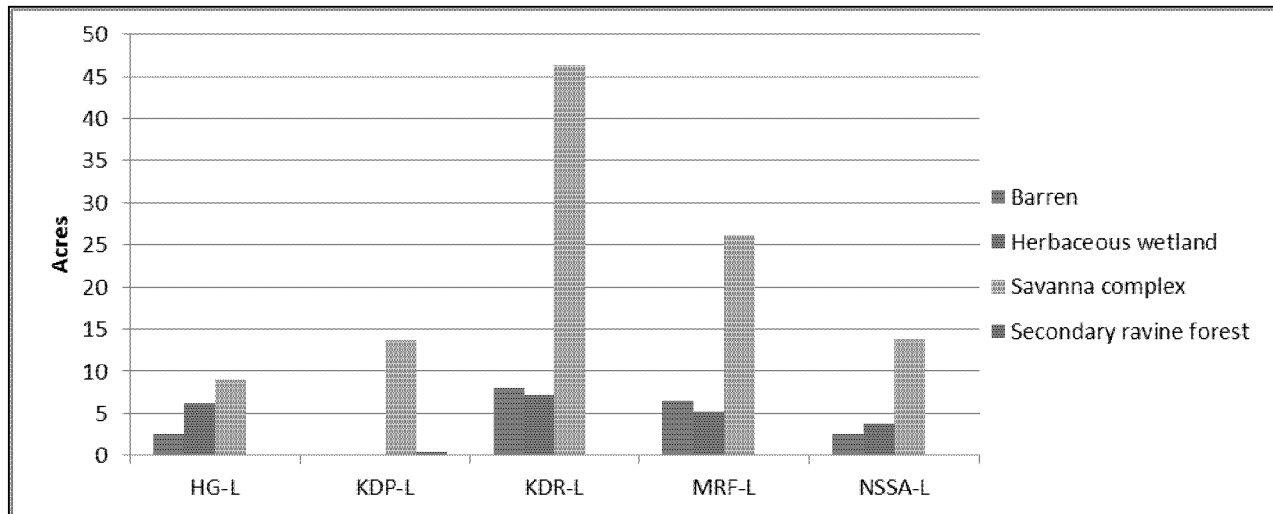
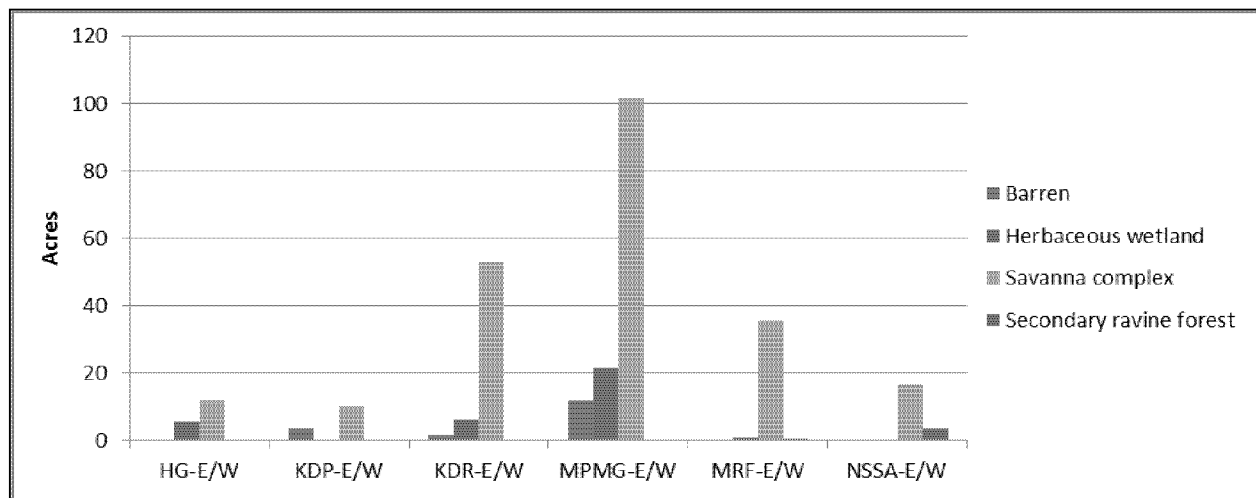


Table 4-2. Vegetation Types and Coverage within the Proposed PLS Ranges in the E/W Configuration

Vegetation Type Location	Vegetation Area (acres) by Range						Total
	HG- E/W	KDP- E/W	KDR- E/W	MPMG- E/W	MRF- E/W	NSSA- E/W	
Secondary Ravine Forest	-	-	0.5	-	0.7	3.5	5
Range Footprint	-	-	-	-	-	-	-
100-m Buffer	-	-	0.5	-	0.7	3.5	4.7
Savanna Complex	11.9	10.4	52.8	101.5	35.7	16.4	229
Range Footprint	1.5	0.7	20.3	49.1	9.5	2.4	83.5
100-m Buffer	10.4	9.7	32.5	52.4	26.2	14.0	145.2
Herbaceous Wetland	5.7	-	6.4	21.7	1.1	-	35
Range Footprint	-	-	-	9.9	-	-	9.9
100-m Buffer	5.7	-	6.4	11.8	1.1	-	25.0
Barren	-	3.7	1.8	12.0	-	-	18
Range Footprint	-	0.1	-	3.7	-	-	3.8
100-m Buffer	-	3.6	1.8	8.3	-	-	13.7
Total	18	14	62	135	38	20	287

Note: Dash (-) indicates vegetation type was not observed or the acreage was less than 0.1.

Figure 4-4. Vegetation Types for the Proposed PLS Ranges in the E/W Configuration



MPMG-E/W and KDR-L Ranges

The proposed MPMG-E/W range is located in an area of open savanna and emergent herbaceous wetland vegetation. The proposed KDR-L range footprint is completely within the proposed MPMG-E/W range footprint, so the vegetation associated with this range is the same as that for the western portion of the proposed MPMG range. The savanna portion was dominated by grasses. The wetland portion was dominated by native sedges and one fern species. In the southwestern portion of the 100-m buffer area for the proposed KDR range and within the southwestern portion of the proposed MPMG range footprint, there was a series of seven side-by-side excavated ponds (visible in aerial imagery – see Figure 2-2) with 10 ft (3 m) or taller berms delineating portions of the perimeter of each. These ponds were dry or, in a few cases, had some small areas of shallow standing water with emergent wetland vegetation. The entire survey area appeared substantially altered by past uses.

KDR-E/W Range

The vegetation within nearly the entire range footprint of the proposed KDR-E/W range was savanna, dominated almost completely by the non-native grass *Pennisetum polystachion*. The proposed KDR-E/W range is located in a gently sloping area adjacent to a large emergent herbaceous wetland that was in the southern region of the 100-m buffer and extended to the south, outside the buffer. In one area near the perimeter of this wetland and within the 100-m buffer there, there was a small patch of the rare (on Guam) fern *Histiopteris incisa*.

MRF-L Range

The proposed MRF-L range footprint is situated in an area of eroded ridges and flats and can be characterized as badland cover with completely bare soil or with sparse or scattered savanna vegetation. The southern portion and the northeast corner of the 100-m buffer area contained emergent, herbaceous wetlands.

MRF-E/W Range

The proposed MRF-E/W range is dominated by savanna vegetation interspersed with areas of eroded barren/badland soil. In many areas, the vegetation adjacent to the eroded badland soils was sparse. A few areas had thick vegetation, dominated by grass species including the native swordgrass (*Miscanthus floridulus*). Near the southern boundary of the 100-m buffer, a wetland of emergent, herbaceous wetland vegetation extended outside of the buffer to the south.

KDP-L Range

The proposed KDP range footprint is small (0.8 acre [0.3 ha]) and is located entirely within savanna dominated by the non-native grass *Pennisetum polystachion* and swordgrass. At the southwest corner of the 100-m buffer was a small area of moderately disturbed ravine forest vegetation.

KDP-E/W Range

The small proposed KDP-E/W range (same size as the L configuration) is located entirely within savanna and also contains large areas of eroded badlands (barren) and extensive berms enclosing several large, dry, rectangular areas visible on aerial imagery (Figure 2-2). Additional bermed areas were present outside the proposed range and buffer area to the northwest. Vegetation was a sparse mix of native and non-native grasses.

NSSA-L Range

The proposed NSSA-L range is located near the headwaters of an unnamed stream (joining the Sagge River and then eventually the Talofoto River) on flat to slightly sloping terrain. Only the southeastern portion of this proposed range was evaluated during field surveys because there was a change in the proposed range layouts after field surveys were completed. The southeastern portion of the buffer area was dominated by species associated with the drainage including the native *Phragmites karka* in very wet areas, *Saccharum spontaneum*, *Fimbristylis* spp. and weedy species such as *Hyptis capitata*. The vegetation within the proposed range footprint area and to the west is likely dominated by native and non-native grasses, including *Miscanthus floridulus* and *Pennisetum polystachion*, based on aerial imagery and field observations of the general area. A large area of barren ground was also in the western buffer area. At this location, the rare (on Guam) fern *Histiopteris incisa* was present and was more abundant than at the proposed KDR-E/W range, but it was still located within a relatively small portion of the eastern portion of the 100-m buffer area.

NSSA-E/W Range

Savanna vegetation, consisting of native and non-native grasses, covered most of this proposed range, including the entire range footprint. The southwest corner of the 100-m buffer area is dominated by open forest, inclusive of several clumps of bamboo, within the Bubulao River valley. To the east and within the buffer area was a small area of open forest with a mix of species.

HG-L Range

The proposed HG-L range was located near the headwaters of an unnamed stream (joining the Sagge River and then eventually the Talofoto River) on flat to slightly sloping terrain. Only the northeastern portion of this proposed range was evaluated during field surveys because there was a shift in the proposed range layouts after field surveys were completed. A wet area within this northeastern portion of the buffer area was dominated by the native sedge *Fimbristylis tristachya*. Further to the south, the area appeared to be drier on aerial imagery and dominated by *Miscanthus floridulus*. The very southeastern portion of the proposed range was barren.

HG-E/W Range

The vegetation in this proposed range consisted of savanna within the proposed range footprint and a portion of the 100-m buffer area, and herbaceous wetland vegetation within a large wetland that extended into the buffer area to the east and west. The savanna was dominated by native swordgrass, which was extremely thick and tall in some areas. The wetlands were dominated by the native grass *Phragmites karka*. Most perimeter areas of the wetlands had native shrubs, as well as a mix of non-native woody and herbaceous species.

4.1.2 Quantitative Vegetation Analysis

The quantitative anchor point analysis revealed a variety of vegetation types. Table 4-3 summarizes some of the major findings of the analysis, with emphasis on a determination of how much of the vegetation is native, therefore indicating the quality of the habitat and degree of degradation.

The primary vegetation type at the proposed private lands ranges is savanna complex. Consequently, the best summary of that vegetation is the anchor point measurements of herbaceous vegetation cover. Pie charts depicting the cover for each of the four anchor points are shown in Figure 4-5.

Table 4-3. Quantitative Vegetation Analysis Data Summary

Anchor Point (Range)†	Vegetation Type	Canopy Overstory (% Native)	Canopy Understory (% Native)	Tree Basal Area Dom*	Tree Abundance Dom*	Herbaceous Plant Cover (% Native)	Woody Plant Seedlings
VP1 (MPMG-E/W)	Herbaceous Wetland	NA	NA	NA	NA	62	NA
VP2 (KDR-E/W)	Savanna Complex	NA	NA	NA	NA	3	NA
VP3 (HG-L)	Herbaceous Wetland	NA	NA	NA	NA	20	NA
VP4 (NSSA-L)	Secondary Ravine Forest	26	22	I	I	47	N: 85 I: 76

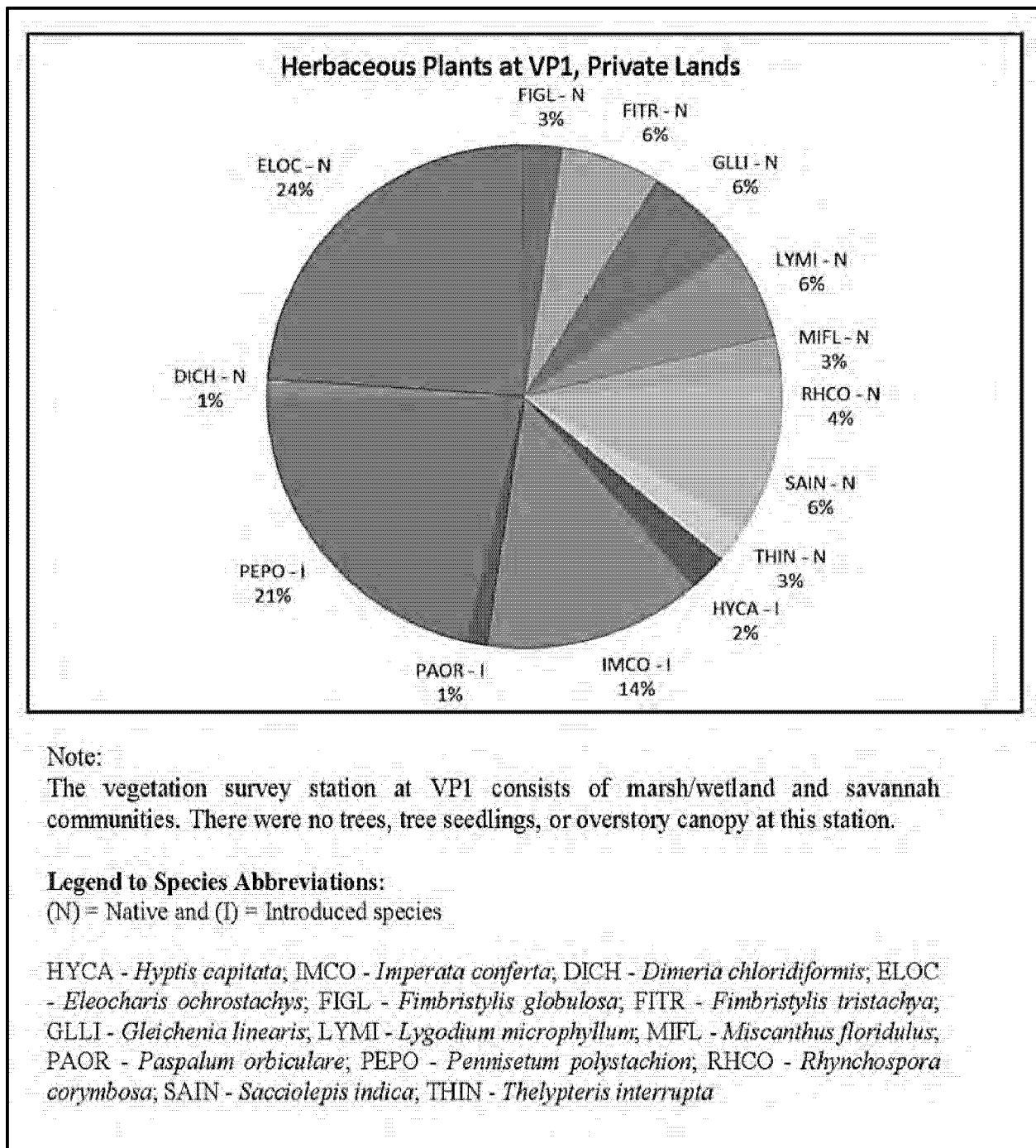
Notes: I = introduced; N = native; NA = not applicable; *Entries in these columns indicate whether the dominant plants (based on basal area or relative abundance) are primarily native (N) or introduced (I); †Anchor Points are depicted on Figure 2-2.

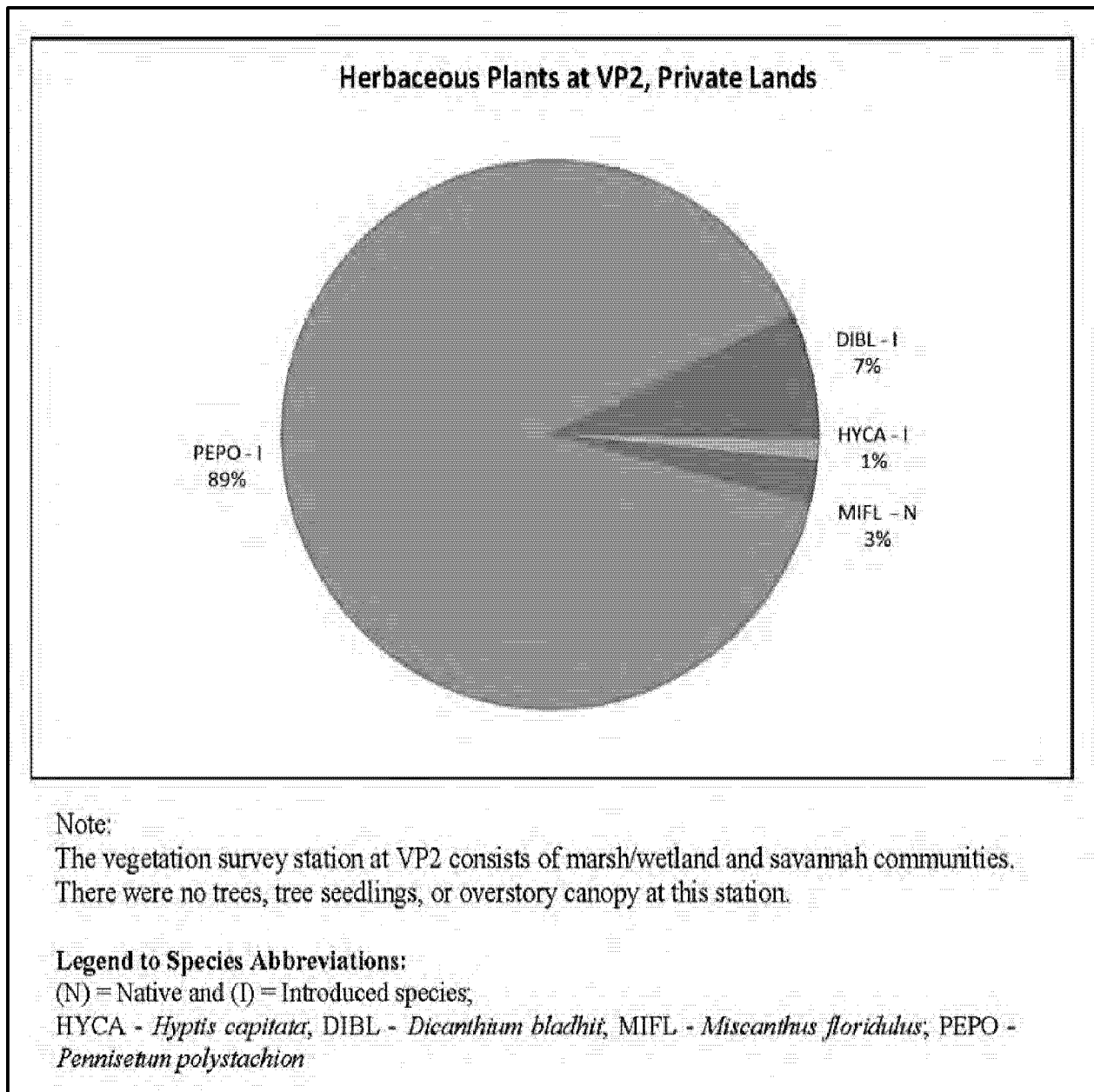
4.1.3 Special-Status Plant Species and Mariana Eight-Spot Butterfly Host Plant

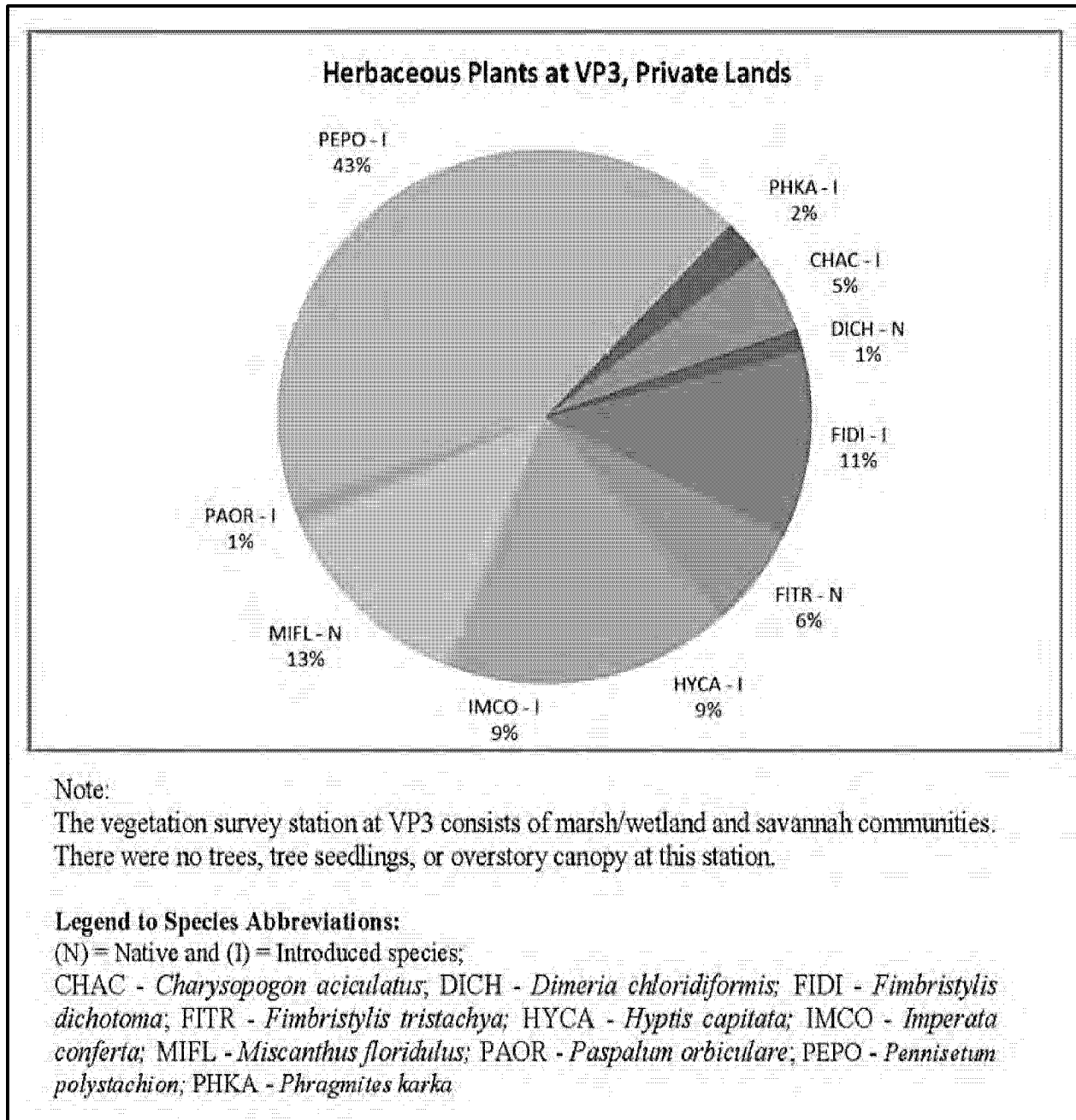
The only special-status plant species identified in surveys at the private lands is *Cycas micronesica*. Since most of the PLS survey area is savanna complex, this species would not typically be present in this habitat, although its habitat includes edges between savanna and forest. Approximately 10-15 individuals ranging from poor to fair condition were observed within the buffer of the proposed KDP-L range in the forested area to the west of the proposed range footprint (Figure 4-2).

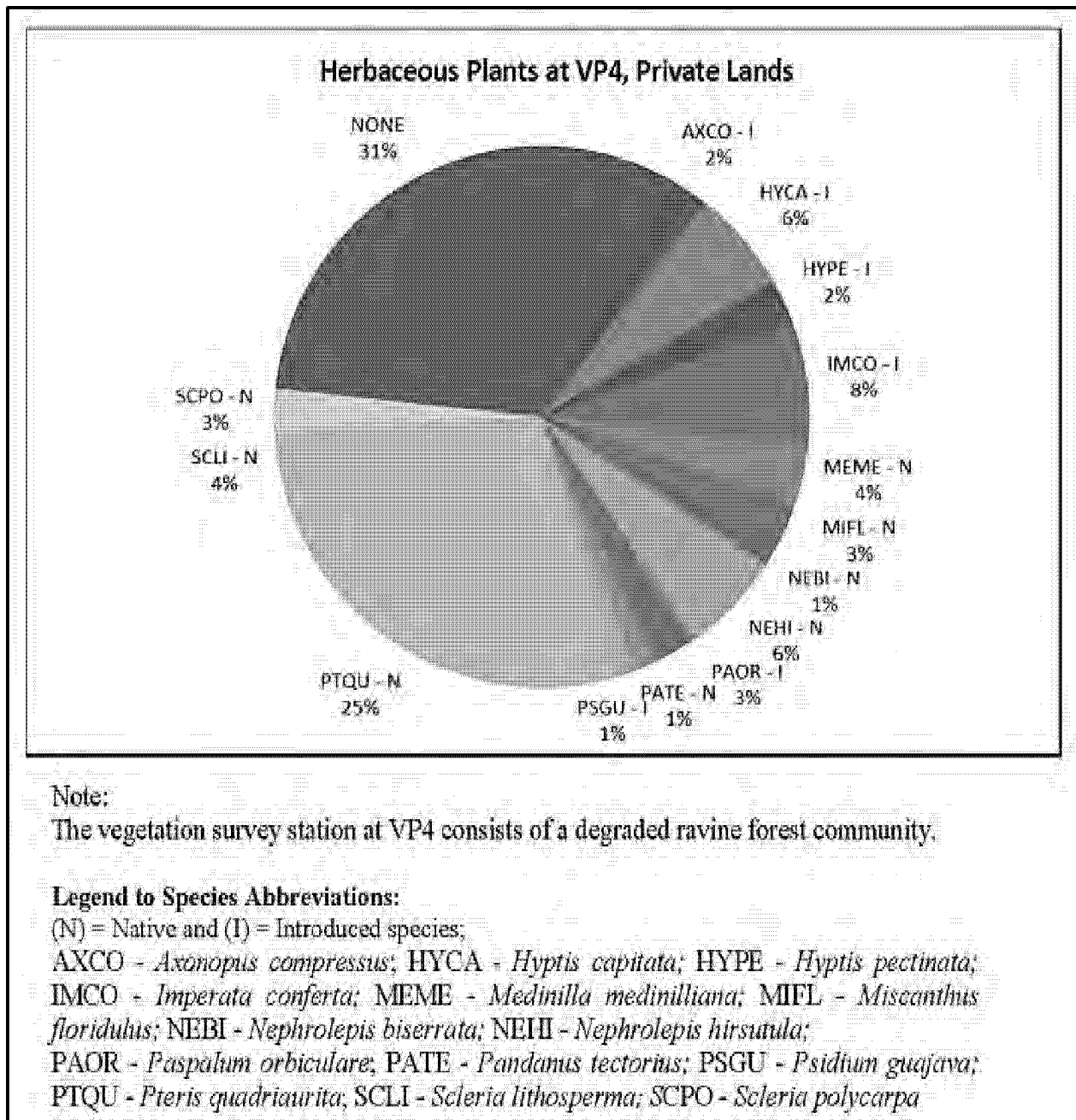
No host plants of the Mariana eight-spot butterfly were observed on the PLS.

Figure 4-5. Herbaceous Plant Cover at PLS Anchor Points









4.2 MARIANA FRUIT BAT AND MARIANA SWIFTLET SURVEYS

The Mariana fruit bat was not observed during the surveys at the PLS.

Mariana swiftlets were observed during all six surveys from stations Bat-Swiftlet Observation Point 3 (BSP3) and BSP4 (1-11 and 2-7 individual birds, respectively) (survey station locations are shown on Figure 2-2). The estimated on-the-ground locations of the sightings are shown in Figure 4-2. Swiftlets were observed during four surveys from station BSP2 (2-7 individual birds), and two surveys from BSP1 (3-6 individual birds). All swiftlet observations occurred between 0557 and 0741 hours.

4.3 AVIAN SURVEYS

No native birds or MBTA species were detected during station surveys. Two native species listed under the MBTA were observed while transiting to and from overlook stations and while at overlook stations on PLS: yellow bittern and white tern.

4.4 REPTILE SURVEYS

Habitat was generally not suitable for special-status reptile species at the PLS. No special-status reptiles were caught or observed during the survey transects.

4.5 TREE SNAIL SURVEYS

All proposed range footprints and almost all of the 100-m buffers are located in savanna grassland or other habitat of herbaceous vegetation that is not suitable tree snail habitat. One small patch of forest near the outer edge of the buffer for the proposed KDP-L range contained potential tree snail habitat. This small forest area was searched and no tree snails were found.

5.0 CONCLUSION

The vegetation on large portions of the proposed MPMG range footprint and 100-m buffer on NMS were determined to be primary limestone forest. Large areas of forested wetland vegetation were present within the proposed KDR range footprint and 100-m buffer on NMS. Large areas of herbaceous wetland vegetation were present on several proposed range footprints or 100-m buffers on PLS. Overall, eight special-status species and one host plant species of the ESA candidate Mariana eight-spot butterfly were identified on NMS and four special-status species were identified on the PLS. These are summarized in Table 5-1 (except for the two MBTA birds, which are both common species).

Table 5-1. Summary of 2012 Surveys of Special-Status Species within Proposed LFTRC Configurations on NMS and PLS

Scientific Name	Common Name (Chamorro Name)	Federal ESA Status	Guam Status	NMS Obs	PLS Obs
Plants					
<i>Cyathea lunulata</i>	Tree fern (<i>Chacha or Tsatsa</i>)	None	Endangered, SOGCN	no	no
<i>Cycas micronesica</i>	Federico nut (<i>Fadang</i>)	None	SOGCN	Yes (MPMG)	Yes (KDP-L)
<i>Elatostema calcareum</i>	None (None)	*	None	no	no
<i>Heritiera longipetiolata</i>	None (<i>Ufa-halomtano</i>)	None	Endangered, SOGCN	no	no
<i>Merrilliodendron megacarpum</i>	None (<i>Faniok</i>)	None	SOGCN	Yes (MPMG)	no
<i>Procris pedunculata</i>	None (None)	*	None	Yes (MPMG)	no
<i>Serianthes nelsonii</i>	Fire tree (<i>Hayun lagu</i>)	Endangered	None	no	no
<i>Tabernaemontana rotensis</i>	None (None)	None	SOGCN	Yes (MPMG)	no
Mammals					
<i>Pteropus m. mariannus</i>	Mariana fruit bat (<i>Fanihi</i>)	Endangered	Endangered, SOGCN	Yes	no
Birds**					
<i>Aerodramus bartschi</i>	Mariana swiftlet (<i>Chachaguak</i>)	Endangered	Endangered, SOGCN	no	Yes
<i>Aplonis opaca guami</i>	Micronesian starling (<i>Sali</i>)	None	Endangered, SOGCN	no	no
<i>Gallinula chloropus guami</i>	Mariana common moorhen (<i>Pulattat</i>)	Endangered	Endangered, SOGCN	Yes (MPMG, MRF)	no
Reptiles					
<i>Lipinia noctua</i>	Moth skink (<i>Guali'ek HalomTano'</i>)	None	Endangered, SOGCN	no	no
<i>Nactus pelagicus</i>	Pacific slender-toed gecko (<i>Guali'ek</i>)	None	Endangered	Yes (MPMG)	no
Invertebrates					
<i>Partula gibba</i>	Humped tree snail (<i>Akaleha'</i>)	Candidate	Endangered SOGCN	no	no
<i>Partula radiolata</i>	Guam tree snail (<i>Akaleha'</i>)	Candidate	Threatened SOGCN	no	no
<i>Samoana fragilis</i>	Fragile tree snail (<i>Akaleha'</i>)	Candidate	Endangered SOGCN	no	no

Notes: *This species is a host plant for the federal ESA candidate Mariana eight-spot butterfly; **Species listed only under the MBTA are not included in this summary.

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**APPENDIX A
VEGETATION SURVEY REPORT**

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APPENDIX B
MARIANA FRUIT BAT AND MARIANA SWIFTLET SURVEY REPORT

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APPENDIX C
AVIAN SURVEY REPORT

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APPENDIX D
HERPETOLOGICAL SURVEY REPORT

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APPENDIX E
TREE SNAIL SURVEY REPORT

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**APPENDIX F
SPECIES LIST**

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